

NUCLEAR SCIENCE ABSTRACTS

Vol. 7 No. 17, September 15, 1953

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ERRATA

NSA, Vol. 6, No. 23, p. 2 of Index. N. F. Freeman should be N. K. Freeman.

NSA, Vol. 7, No. 11, p. 367. In abstract 3007 and in ISC-296 on p. v of Reports Reference List, Carol M. Byrd should be Carol H. Byrd.

NSA, Vol. 7, No. 12A, p. 3 of Index. Linder, M. should be Lindner, M.

NSA, Vol. 7, No. 13, p. F of Index. In the journal reference for MDDC-1546, (1938) should be (1948).

CALENDAR OF MEETINGS

Suggestions for additions to this list will be welcomed and should be sent with all pertinent information to the Cataloging Branch, Technical Information Service, U. S. Atomic Energy Commission, P. O. Box 62, Oak Ridge, Tennessee.

October 18-22, 1953

SOCIETY FOR NONDESTRUCTIVE TESTING, INC., Cleveland, Ohio

October 29-30, 1953

CONFERENCE ON ATOMIC ENERGY, Waldorf-Astoria Hotel, New York, Sponsored by: National Industrial Conference Board.

Inquiries should be addressed to: R. Maxil Ballinger, Division of Business Practices, National Industrial Conference Board, 247 Park Avenue, New York 17, N. Y.

March 15-19, 1954

ELEVATED TEMPERATURE CORROSION SYMPOSIUM, Municipal Auditorium, Kansas City, Mo. Sponsored by: National Association of Corrosion Engineers - 10th Annual Conference

Person to Contact: Glenn A. Fitzlen
Ass't. Technical Director
Haynes Stellite Co.
Kokomo, Ind.

June 20-25, 1954

NUCLEAR ENERGY MEETING, University of Michigan, Ann Arbor, Michigan, Sponsored by: American Institute of Chemical Engineers.

Inquiries should be addressed to: Professor Donald Katz, University of Michigan, Department of Engineers, Ann Arbor, Michigan.

REPORTS REFERENCE LIST

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The abstract number for each report is listed at the upper right of the entry. If the number bears an asterisk, the report is title listed only and no abstract is included.

USAEC DECLASSIFIED REPORTS

- AECD-3529 4757
Oak Ridge National Lab.
RADIATION STABILITY STUDIES: PART 1. AQUEOUS ETHYLENEDIAMINE TETRAACETATE AND ACETATE SOLUTIONS. PART 2. BECKMAN GLASS pH ELECTRODES. R. E. Blanco, A. H. Kibbey, and J. H. Pannell. Issued Sept. 22, 1952. Decl. with deletions June 1, 1953. 18p. (AECD-3529; ORNL-1379)
- AECD-3532 4702
Atomic Energy Project, Univ. of Rochester
THERMAL BURNS FROM THE ATOMIC BOMB. Herman E. Pearse and Harry D. Kingsley. Apr. 30, 1953. Decl. with deletions June 30, 1953. 43p. (AECD-3532; UR-254)
- AECD-3533 4788
Battelle Memorial Inst.
PREPARATION AND EXAMINATION OF BERYLLIUM CARBIDE. M. W. Mallett, E. A. Durbin, M. C. Udy, D. A. Vaughan, and E. J. Center. May 25, 1953. Decl. June 26, 1953. 24p. (AECD-3533; BMI-MWM-5)
- AECD-3534 4760
Ames Lab.
CAUSTIC TREATMENT OF ZIRCON IN THE PREPARATION OF PURE ZIRCONIUM COMPOUNDS. Donald R. Spink and H. A. Wilhelm. Mar. 1952. Decl. with deletions June 23, 1953. 55p. (AECD-3534; ISC-217)
- AECD-3536 4955
Mound Lab.
DETERMINATION OF HALF LIFE OF POLONIUM-210 BY COUNTING: FINAL REPORT. Mary Lou Curtis. June 1, 1951. Decl. July 9, 1953. 8p. (AECD-3536; MLM-575)
- AECD-3537 4801
Battelle Memorial Inst.
THE URANIUM-TITANIUM ALLOY SYSTEM. Murray C. Udy and Francis W. Boulger. Nov. 5, 1952. Decl. June 5, 1953. 18p. (AECD-3537; BMI-774)
- AECD-3538 4802
Oak Ridge National Lab.
DISSOLUTION OF NaK. J. C. White, C. K. Talbott, and L. J. Brady. Dec. 2, 1952. Decl. June 11, 1953. 9p. (AECD-3538; ORNL-1453)
- AECD-3539 4722
Atomic Energy Project, Univ. of Rochester
PRESENT STATUS OF POLONIUM TOLERANCE ESTIMATIONS. J. B. Hursh and J. N. Stannard. Oct. 14, 1948. Decl. with deletions June 1, 1953. 33p. (AECD-3539; UR-44)

USAEC UNCLASSIFIED REPORTS

- AECU-2589 4903
Ames Lab.
ANGULAR AND ENERGY DISTRIBUTIONS OF PHOTO-PROTONS FROM ALUMINUM AND TANTALUM. M. M. Hoffman and A. G. W. Cameron. [Mar. 30, 1953] 35p. (AECU-2589)
- AECU-2591 4728
Foundation for Industrial Research, Univ. of Wichita
THE PERMEABILITY METHOD OF DETERMINING SURFACE AREAS OF FINELY DIVIDED MATERIALS. May 1, 1953. 111p. (AECU-2591; Report 2)
- AECU-2592 4793
Oregon Univ.
ELECTROCHEMICAL AND POLAROGRAPHIC STUDIES ON THE CORROSION OF ZIRCONIUM IN PRESENCE OF VARIOUS AQUEOUS MEDIA; PROGRESS REPORT. George B. Adams, Jr., Mario Maraghini, and Pierre Van Rysselberghe. June 12, 1953. 9p. (AECU-2592)
- AECU-2593 4968
Los Alamos Scientific Lab.
THE CRYSTAL STRUCTURE OF NEODYMIUM METAL AND OF NEODYMIUM MONOXIDE. F. H. Ellinger. [1953] 11p. (AECU-2593; LADC-1460)
- AECU-2594 4856
Los Alamos Scientific Lab.
RESPONSE OF THE LONG COUNTER. R. A. Nobles, Robert B. Day, R. L. Henkel, G. A. Jarvis, J. L. McKibben, R. P. Kutarnia, J. E. Perry, Jr., and R. K. Smith. [1953] 7p. (AECU-2594; LADC-1427)
- AECU-2595 4969
Los Alamos Scientific Lab.
THE CRYSTAL STRUCTURE OF SAMARIUM METAL AND OF SAMARIUM MONOXIDE. F. H. Ellinger and W. H. Zachariasen. [1953] 12p. (AECU-2595; LADC-1455)
- AECU-2596 4729
Noyes Chemical Lab., Univ. of Ill.
INTERMOLECULAR CARBON ISOTOPE EFFECT IN THE DECARBOXYLATION OF NORMAL MALONIC ACID IN QUINOLINE SOLUTION. Peter E. Yankwich and R. Linn Belford. [1953] 18p. (AECU-2596)
- AECU-2597 4703
Cancer Research Inst., New England Deaconess Hospital, Boston
PHASE MICROSCOPY. Edna H. Tompkins. [1953] 7p. (AECU-2597)
- AECU-2598 4716
[Cancer Research Inst.], New England Deaconess Hospital, Boston

- RADIOISOTOPES IN THE HOSPITAL. R. F. Cowing and Shields Warren. [1953] 10p. (AECU-2598) 4957
- AECU-2599 4943
Los Alamos Scientific Lab.
SMALL ANGLE CROSS SECTIONS FOR THE SCATTERING OF PROTONS BY TRITONS (thesis). Malcolm Eugene Ennis. June 1953. 111p. (AECU-2599; LADC-1453)
- AECU-2600 4704
Academy of Natural Sciences of Philadelphia
SAVANNAH RIVER BIOLOGICAL SURVEY, JUNE 1951-MAY 1952. FINAL REPORT FOR E. I. DU PONT DE NEMOURS AND COMPANY, SAVANNAH RIVER PLANT. Feb. 1953. 330p. (AECU-2600)
- ANL-5015 4770
Argonne National Lab.
ABSORPTION OF SOME HALOGEN GASES FROM AIR BY A LIMESTONE BED AND A SPRAY TOWER. R. C. Liimatainen and M. Levenson. Apr. 1, 1953. 30p. (ANL-5015)
- ANL-5020 4731
Argonne National Lab.
DISSOLUTION OF ZIRCONIUM IN HYDROFLUORIC ACID. John E. Baumrucker. Mar. 31, 1950. 18p. (ANL-5020)
- ANL-5038 4789
Argonne National Lab.
PREPARATION OF URANIA REFRACTORIES. George B. Eyerly, W. A. Lambertson, R. G. Kraft, and R. E. Corwin. Mar. 24, 1953. 7p. (ANL-5038)
- ANL-5072 4842
Argonne National Lab.
A METHOD FOR STABILIZING SCALING CIRCUITS. Jerome L. Lerner. June 5, 1953. 8p. (ANL-5072)
- ANL-5086 4711
Argonne National Lab.
BIOLOGICAL AND MEDICAL RESEARCH, RADIOLOGICAL PHYSICS, AND HEALTH SERVICES DIVISIONS MONTHLY PROGRESS REPORT [FOR] JUNE 1953. July 1953. 20p. (ANL-5086)
- BNL-232 4826
Brookhaven National Lab.
QUARTERLY PROGRESS REPORT [FOR] JANUARY 1-MARCH 31, 1953; UNCLASSIFIED SECTION. 44p. (BNL-232)
- BNL-1431 4956
Brookhaven National Lab.
RADIATIONS FROM Rb^{86} AND $\text{Rb}^{86\text{m}}$. Robert B. Schwartz, M. L. Perlman, and W. Bernstein. [1952] 9p. (BNL-1431)
- BNL-1434 4705
Brookhaven National Lab.
METHOD OF CULTURE AND GROWTH OF MAIZE ENDOSPERM *IN VITRO*. Elizabeth Piecsur Sternheimer. [1952] 6p. (BNL-1434)
- BNL-1435 4905
Brookhaven National Lab.
NEUTRON AND MESON STARS INDUCED IN THE LIGHT ELEMENTS OF THE EMULSION. M. Blau, A. R. Oliver, and J. E. Smith. [1952] 38p. (BNL-1435)
- BNL-1437 4906
Brookhaven National Lab.
SUCCESSIVE NEUTRON CAPTURE IN Ta. J. W. Mihelich. [1952] 3p. (BNL-1437)
- BNL-1439 4723
Brookhaven National Lab.
THE COMPARTMENTATION AND KINETICS OF BODY WATER. James S. Robertson. [1952] 8p. (BNL-1439)
- BNL-1440 4957
Brookhaven National Lab.
AVERAGE CHARGE ON THE DAUGHTER ATOMS PRODUCED IN THE DECAY OF A^{31} AND $\text{Xe}^{131\text{m}}$. M. L. Perlman and J. A. Miskel. [1953] 20p. (BNL-1440)
- BNL-1441 4883
Brookhaven National Lab.
THE HALF-LIFE OF THALLIUM-204. Garman Harbottle. [1953] 4p. (BNL-1441)
- BNL-1442 4753
Brookhaven National Lab.
THE PRODUCTION OF IODINE FROM SOLUTIONS OF POTASSIUM IODIDE IRRADIATED WITH HARD X-RAYS. Everett R. Johnson. [1952] 6p. (BNL-1442)
- BNL-1445 4912
Brookhaven National Lab.
THE COSMOTRON: A REVIEW. M. Hildred Blewett. [1953] 51p. (BNL-1445)
- BNL-1446 4913
Brookhaven National Lab.
[COSMOTRON] MAGNET. PART 1. DESIGN. J. P. Blewett, M. H. Blewett, G. K. Green, W. H. Moore, and L. W. Smith. [1953] 27p. (BNL-1446)
- BNL-1447 4914
Brookhaven National Lab.
[COSMOTRON] MAGNET. PART 2. MAGNETIC MEASUREMENTS. G. K. Green, R. R. Kassner, W. H. Moore, and L. W. Smith [1953] 54p. (BNL-1447)
- BNL-1448 4915
Brookhaven National Lab.
[COSMOTRON] MAGNET. PART 3. MECHANICAL DESIGN, FABRICATION, AND ERECTION. R. A. Meyer and W. H. Moore. [1953] 23p. (BNL-1448)
- BNL-1449 4916
Brookhaven National Lab.
[COSMOTRON] MAGNET. PART 4. TESTING PROGRAM FOR THE INDIVIDUAL BLOCKS OF THE MAGNET. M. H. Blewett, J. M. Kelly, and W. H. Moore. [1953] 18p. (BNL-1449)
- BNL-1450 4917
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[COSMOTRON] MAGNET. PART 5. COIL. J. A. Kosh and M. Livingston. [1953] 19p. (BNL-1450)
- BNL-1451 4918
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[COSMOTRON] MAGNET. PART 6. POWER SUPPLY. G. K. Green and E. E. Shelton. [1953] 17p. (BNL-1451)
- BNL-1452 4919
Brookhaven National Lab.
[COSMOTRON] POLE-FACE WINDINGS. PART 1. DESIGN. J. P. Blewett, M. H. Blewett, W. H. Moore, and L. W. Smith. [1953] 18p. (BNL-1452)
- BNL-1453 4920
Brookhaven National Lab.
[COSMOTRON] POLE-FACE WINDINGS. PART 2. FABRICATION. John J. Mede. [1953] 8p. (BNL-1453)
- BNL-1454 4921
Brookhaven National Lab.
[COSMOTRON] R-F SYSTEM. PART 1. DESIGN PRINCIPLES. John P. Blewett. [1953] 16p. (BNL-1454)
- BNL-1455 4922
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[COSMOTRON] R-F SYSTEM. PART 2. FREQUENCY

- CONTROL. J. P. Blewett, E. J. Rogers, and C. E. Swartz. [1953] 29p. (BNL-1455) 4923
- BNL-1456
Brookhaven National Lab.
[COSMOTRON] R-F SYSTEM. PART 3. POWER AMPLIFIER. M. Plotkin and L. C. L. Yuan. [1953] 22p. (BNL-1456)
- BNL-1457
Brookhaven National Lab.
[COSMOTRON] R-F SYSTEM. PART 4. ACCELERATING UNIT. J. P. Blewett, M. Plotkin, and E. J. Rogers. [1953] 22p. (BNL-1457) 4924
- BNL-1458
Brookhaven National Lab.
[COSMOTRON] R-F SYSTEM. PART 5. PROPERTIES OF FERROMAGNETIC FERRITES. J. P. Blewett, M. H. Blewett, and M. Plotkin. [1953] 26p. (BNL-1458) 4925
- BNL-1459
Brookhaven National Lab.
[COSMOTRON] INJECTION SYSTEM. PART 1. VAN DE GRAAFF ACCELERATOR. E. J. Rogers and C. M. Turner. [1953] 35p. (BNL-1459) 4926
- BNL-1460
Brookhaven National Lab.
[COSMOTRON] INJECTION SYSTEM. PART 2. INJECTION OPTICS. J. G. Cottingham, W. H. Moore, E. J. Rogers, and C. M. Turner. [1953] 18p. (BNL-1460) 4927
- BNL-1461
Brookhaven National Lab.
[COSMOTRON] VACUUM SYSTEM. PART 1. VACUUM CHAMBER. D. D. Jacobus and I. J. Polk. [1953] 48p. (BNL-1461) 4928
- BNL-1462
Brookhaven National Lab.
[COSMOTRON] VACUUM SYSTEM. PART 2. PUMPING SYSTEM. D. Kassner and C. Lasky. [1953] 18p. (BNL-1462) 4929
- BNL-1463
Brookhaven National Lab.
REVISION OF GAS SCATTERING THEORY. Ernest D. Courant. [1953] 8p. (BNL-1463) 4930
- BNL-1464
Brookhaven National Lab.
[COSMOTRON] CONTROL SYSTEM. PART 1. CENTRAL CONTROL AND WIRING. G. K. Green and R. R. Kassner. [1953] 31p. (BNL-1464) 4931
- BNL-1465
Brookhaven National Lab.
[COSMOTRON] CONTROL SYSTEM. PART 2. TIMING SYSTEM. E. W. Dexter. [1953] 10p. (BNL-1465) 4932
- BNL-1466
Brookhaven National Lab.
[COSMOTRON] CONTROL SYSTEM. PART 3. PEAKING STRIPS. S. Giordano, G. K. Green, and E. J. Rogers. [1953] 12p. (BNL-1466) 4933
- BNL-1467
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[COSMOTRON] CONTROL SYSTEM. PART 4. PICK-UP ELECTRODES. C. E. Swartz. [1953] 12p. (BNL-1467) 4934
- BNL-1468
Brookhaven National Lab.
THE COSMOTRON BUILDING. L. D. Stoughton. [1953] 8p. (BNL-1468) 4935
- BNL-1469
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EDDY CURRENT PHENOMENA IN THE COSMOTRON. M. Hildred Biewett. [1953] 25p. (BNL-1469) 4936
- BNL-1470
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STUDIES OF INJECTION PHENOMENA IN THE COSMOTRON. M. Hildred Biewett, G. K. Green, R. R. Kassner, W. H. Moore, L. W. Smith, and H. S. Snyder. [1953] 39p. (BNL-1470) 4937
- BNL-1471
Brookhaven National Lab.
CALCULATION OF THE [COSMOTRON]. PROTONS' RADIAL OSCILLATIONS AT INJECTION. Ernest D. Courant and R. M. Sternheimer. [1953] 7p. (BNL-1471) 4938
- BNL-1474
Brookhaven National Lab.
SOME GENERAL PROBLEMS IN OPERATING A RESEARCH REACTOR. Robert W. Powell. [1953] 23p. (BNL-1474) 4899
- BNL-1477
Brookhaven National Lab.
ALKALOID BIOGENESIS. 4. THE NON-AVAILABILITY OF NICOTINIC ACID-CARBOXYL-¹⁴C AND ITS ETHYL ESTER FOR NICOTINE BIOSYNTHESIS. R. F. Dawson, David R. Christman, and R. Christian Anderson. [1952] 7p. (BNL-1477) 4772
- BNL-1478
Brookhaven National Lab.
THE EFFECT OF VARIATIONS OF SODIUM INTAKE AND OF DESOXYCORTICOSTERONE ON THE RELATIONSHIP OF THE SODIUM SPACE TO THE CHLORIDE SPACE IN DOGS. J. L. Gamble, Jr. [1953] 27p. (BNL-1478) 4724
- BNL-1481
Brookhaven National Lab.
FAST NEUTRON CROSS SECTIONS AND NUCLEAR LEVEL DENSITY. D. J. Hughes, R. C. Garth, and J. S. Levin. [1953] 26p. (BNL-1481) 4884
- BNL-1482
Brookhaven National Lab.
INHIBITORY EFFECT OF AROMATIC ACIDS ON THE D-AMINO ACID OXIDASE. J. Raymond Klein. [1953] 19p. (BNL-1482) 4732
- BNL-1486
Brookhaven National Lab.
TEMPERATURE INDEPENDENT FACTOR IN THE RELATIVE RATES OF ISOTOPIC THREE CENTER REACTIONS. Jacob Bigeleisen and Max Wolfsberg. [1953] 11p. (BNL-1486) 4733
- BNL-1488
Brookhaven National Lab.
RUTHENIUM ISOTOPE ABUNDANCES. Lewis Friedman and A. P. Irsa. [1952] 7p. (BNL-1488) 4850
- BNL-1495
Brookhaven National Lab.
PHENYLALANINE AND TYROSINE UTILIZATION IN NORMAL AND PHENYLALANINE-DEFICIENT YOUNG MICE. C. R. Grau and Robert Steele. [1952] 24p. (BNL-1495) 4725
- BNL-1498
Brookhaven National Lab.
THE YIELDS OF FREE H AND OH IN THE IRRADIATION OF WATER. A. O. Allen. [1953] 25p. (BNL-1498) 4754
- BNL-1499
Brookhaven National Lab.
SOLVATES OF CHLOROPHYLLS AND RELATED SUB-

- STANCES AND THEIR EQUILIBRIA. Simon Freed and Kenneth M. Sancier. [1953] 48p. (BNL-1499)
- BNL-1500 4707
Brookhaven National Lab.
ON THE EXISTENCE OF THREE OR MORE CHLORO-PHYLLS b. Simon Freed and Kenneth M. Sancier. [1952] 10p. (BNL-1500)
- BRL-Memo-626 4784
Ballistic Research Labs., Aberdeen Proving Ground
SHOCK TUBE TESTS OF GLAZING MATERIALS. William J. Taylor and Robert O. Clark. Nov. 1952. 37p. (BRL-Memo-626)
- COO-181 4807
Armour Research Foundation
PHASE DIAGRAMS OF ZIRCONIUM-BASE BINARY ALLOYS, REPORT 10. THE ZIRCONIUM-OXYGEN SYSTEM, REPORT 4, SUMMARY. April 1, 1952-MARCH 31, 1953. Robert F. Domagala and Donald J. McPherson. Mar. 31, 1953. 57p. (COO-181)
- HW-27744 4843
Hanford Works
AN AUTOMATIC PHOTOMETER. W. N. Carson, Jr. and C. E. Michelson. Apr. 30, 1953. 17p. (HW-27744)
- ISC-229 4970
Ames Lab.
THE RESISTIVITY OF LANTHANUM, CERIUM, PRASEODYMIUM AND NEODYMIUM AT LOW TEMPERATURES. Nancy R. James, Sam Legvold, and Frank H. Spedding. Mar. 1952. 54p. (ISC-229)
- ISC-273 4747
Ames Lab.
COMPOUNDS OF THORIUM WITH TRANSITION METALS OF THE FIRST PERIOD. 2. THE THORIUM-IRON, THORIUM-COBALT AND THORIUM-NICKEL SYSTEMS. John Victor Florio and R. E. Rundle. June 1, 1952. 54p. (ISC-273)
- ISC-304 4746
Ames Lab.
TITRIMETRIC DETERMINATION OF THORIUM. James S. Fritz and John J. Ford. Jan. 1, 1953. 11p. (ISC-304)
- ISC-330 4763
Ames Lab.
A GENERALIZATION OF THE POLANYI THEORY OF ADSORPTION FROM SOLUTION. Robert S. Hansen and Walter V. Fackler, Jr. Feb. 15, 1953. 14p. (ISC-330)
- ISC-333 4734
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REACTION OF IRON(II) WITH 1,2-CYCLOHEXANEDIONEDIOXIME IN ACID SOLUTION. Charles V. Banks and Elaine K. Byrd. [Apr. 8, 1953.] 18p. (ISC-333)
- ISC-345 4858
Ames Lab.
A BETA-RAY SPECTROMETER FOR COINCIDENCE MEASUREMENTS. R. T. Nichols, A. V. Pohm, J. H. Talboy, Jr., and E. N. Jensen. May 15, 1953. 37p. (ISC-345)
- ISC-349 4759
Ames Lab.
A PRACTICAL SEPARATION OF YTTRIUM GROUP RARE EARTHS FROM GADOLINITE BY ION-EXCHANGE. F. H. Spedding and J. E. Powell. May 27, 1953. 32p. (ISC-349)
- ISC-364 4827
Ames Lab.
SPECTRAL AND TOTAL EMISSIVITY: A GUIDE TO THE LITERATURE (1910-1951). Maynard P. Bauleke. June 1, 1953. 41p. (ISC-364)
- LA-1557 4854
Los Alamos Scientific Lab.
HEURISTIC STUDIES IN PROBLEMS OF MATHEMATICAL PHYSICS ON HIGH SPEED COMPUTING MACHINES. John Pasta and S. Ulam. June 9, 1953. 26p. (LA-1557)
- MTA-7 4764
Livermore Research Lab., Calif. Research and Development Co.
CASCADE ANALYSIS OF TRANSIENT BEHAVIOR IN MULTIPLE STAGewise CONTACTING UNITS. P. L. Auer and C. S. Gardner. Mar. 12, 1953. 19p. (MTA-7)
- MTA-28 4944
Livermore Research Lab., Calif. Research and Development Co.
TOTAL ATTENUATION CROSS SECTIONS FOR HIGH ENERGY PROTONS. D. A. Hicks and A. J. Kirschbaum. Dec. 17, 1952. 23p. (MTA-28)
- MTA-31 4859
Livermore Research Lab., Calif. Research and Development Co.
A SCINTILLATION SPECTROMETER FOR ROUTINE USE. G. D. O'Kelley. Dec. 4, 1952. 17p. (MTA-31)
- NYO-894 4813
Rensselaer Polytechnic Inst.
ANISOTROPIC DIFFUSION: PROGRESS REPORT. H. B. Huntington, G. A. Shirn, and E. S. Wajda. [July 1, 1953] 22p. (NYO-894; Progress Report 2)
- NYO-3077 4907
Nuclear Development Associates, Inc.
TABLES OF PENETRABILITIES FOR CHARGED PARTICLE REACTION. Herman Feshbach, M. M. Shapiro, and V. F. Weisskopf. June 15, 1953. 117p. (NYO-3077; NDA-15B-5)
- NYO-3152 4780
Columbia Univ.
BOILING AND CONDENSING OF LIQUID METALS. C. F. Bonilla and B. Misra. April 25, 1953. 9p. (NYO-3152)
- NYO-3646 4791
Massachusetts Inst. of Tech.
THE MEASUREMENT OF THERMAL CONDUCTIVITY OF REFRACTORY MATERIALS; PROGRESS REPORT. F. N. Norton, W. D. Kingery, et al. July 1, 1953. 10p. (NYO-3646)
- NYO-3694 4738
Metals Research Lab., Carnegie Inst. of Tech.
ELECTROCHEMICAL STUDIES OF NON-AQUEOUS MELTS: QUARTERLY PROGRESS REPORT [FOR] PERIOD ENDING JUNE 15, 1953. Robert F. Mehl and Gerhard Derge. July 10, 1953. 15p. (NYO-3694)
- NYO-3819 4814
Massachusetts Inst. of Tech.
SOLID SOLUTIONS AND GRAIN BOUNDARIES: TECHNICAL PROGRESS REPORT NO. 16, SCOPE 2. B. L. Averbach, M. Cohen, W. F. Flanagan, F. Herbstein, J. Hilliard, P. S. Rudman, and E. E. Underwood. June 30, 1953. 4p. (NYO-3819)
- NYO-6228 4775
Powder Weld Process Co.
[RESEARCH INTO MATERIALS AND METHODS TO PRODUCE POLYETHYLENE LININGS ON CONCRETE AND OTHER SURFACES]; PROGRESS REPORT. R. A. Wiese. June 27, 1953. 20p. (NYO-6228)
- ORNL-1557 4765
Oak Ridge National Lab.
STUDIES ON THE ELECTROLYTIC SEPARATION AND DETERMINATION OF TIN, ANTIMONY, AND BISMUTH

WITH CONTROLLED CATHODE POTENTIAL. S. A. Reynolds. Issued July 6, 1953. 58p. (ORNL-1557)

ADSORPTION. John B. Hursh. May 15, 1953. 25p. (UR-258)

ORO-97 4708
Oak Ridge Inst. of Nuclear Studies
QUARTERLY PROGRESS REPORT [FOR] JANUARY 1 -
MARCH 31, 1953. 30p. (ORO-97)

UR-259 4726
Atomic Energy Project, Univ. of Rochester
PRODUCTION OF PLASMA AND TISSUE PROTEINS BY
NON-HEPATIC RAT ORGANS AS STUDIED WITH LYSINE-
 ϵ - C^{14} . C. G. Bly, L. L. Miller, and W. F. Bale. May 26,
1953. 47p. (UR-259)

RME-4016 4794
Division of Raw Materials, AEC
URANIUM INVESTIGATIONS NEAR ALADDIN, CROOK
COUNTY, WYOMING. Joseph R. Gray and Anthony C.
Tennissen. Issued May 1953. 13p. (RME-4016)

OTHER UNCLASSIFIED REPORTS OF SPECIAL INTEREST TO AEC LABORATORIES

TID-4005(pt.1) 4701
Atomic Energy Commission
[SUMMARIES OF UNCLASSIFIED BASIC RESEARCH IN
METALLURGY.] [Nov. 30, 1952] 47p. (TID-4005(pt.1))

AERE-CE/M-54 4751
Atomic Energy Research Establishment, Harwell, Berks
(England)
A MAGNETIC FILTER—PRELIMINARY DEVELOPMENT.
D. F. Kelsall. July 1950. 12p. (AERE-CE/M-54)

UCLA-51.15 4776
California Univ., Los Angeles
MASONRY STRUCTURES UNDER BLAST. C. Martin Duke.
Dec. 1951. 31p. (UCLA-51.15)

AERE-CE/R-903 4761
Atomic Energy Research Establishment, Harwell, Berks
(England)
LIQUID-LIQUID EXTRACTION. PART 4. A FURTHER
STUDY OF HOLD-UP IN PACKED COLUMNS. R. L.
Gayler, N. W. Roberts, and H. R. C. Pratt. Mar. 6, 1953.
35p. (AERE-CE/R-903)

UCLA-259 4717
Atomic Energy Project, Univ. of Calif., Los Angeles
THE AVAILABILITY OF RADIO-STRONTIUM TO MAM-
MALS BY WAY OF THE FOOD CHAIN. Warren J. Gross,
Janice F. Taylor, Joshua A. Lee, and James C. Watson.
Issued June 18, 1953. 26p. (UCLA-259)

AERE-CE/R-904 4762
Atomic Energy Research Establishment, Harwell, Berks
(England)
LIQUID-LIQUID EXTRACTION. PART 5. FURTHER
STUDIES OF DROPLET BEHAVIOUR IN PACKED COL-
UMNS. R. L. Gayler and H. R. C. Pratt. Mar. 1953. 16p.
(AERE-CE/R-904)

UCLA-261 4845
Atomic Energy Project, Univ. of Calif., Los Angeles
COUPLED THROUGH-FOCUS CONTROL FOR THE RCA
TYPE EMU-28 ELECTRON MICROSCOPE. F. W. Bishop
and M. L. Cook. Issued June 25, 1953. 8p. (UCLA-261)

AERE-C/R-1136 4857
Atomic Energy Research Establishment, Harwell, Berks
(England)
THE INTENSITY OF BETA ACTIVITY FROM THICK
SOURCES. G. N. Walton, J. S. Thompson, and I. F. Croall.
Mar. 5, 1953. 30p. (AERE-C/R-1136)

UCRL-2159 4873
Radiation Lab., Univ. of Calif., Berkeley
THE PRODUCTION OF MESONS BY PHOTONS AT 0° (rev.
thesis). Nelson Jarmie. Mar. 1953. 37p. (UCRL-2159)

AERE-C/R-1177 4745
Atomic Energy Research Establishment, Harwell, Berks
(England)
A RAPID METHOD FOR THE SEMI-QUANTITATIVE
SPECTROGRAPHIC ANALYSIS OF A WIDE RANGE OF
MATERIALS. F. T. Birks. May 6, 1953. 7p. (AERE-
C/R-1177)

UCRL-2162 4973
Radiation Lab., Univ. of Calif., Berkeley
STUDIES IN β - AND γ -RAY SPECTROSCOPY (thesis).
Harry Tyson Easterday. Mar. 1953. 41p. (UCRL-2162)

UCRL-2165 4939
Radiation Lab., Univ. of Calif., Berkeley
VERIFICATION OF SYNCHROTRON BEAM FINE STRUC-
TURE. Nelson Jarmie. Apr. 3, 1953. 7p. (UCRL-2165)

AERE-E/M-52 4804
[Atomic Energy Research Establishment, Harwell, Berks
(England)]
NOTES ON THE HOT WIRE METHOD FOR DETERMINING
THE THERMAL CONDUCTIVITY OF A METAL. D. V.
Wordsworth. [nd] 29p. (AERE-E/M-52)

UCRL-2176 4787
Radiation Lab., Univ. of Calif., Berkeley
MEASUREMENTS OF THE EFFECTS OF MOISTURE IN
NUCLEAR TRACK EMULSION. Albert J. Oliver. Apr. 6,
1953. 20p. (UCRL-2176)

AERE-I/R-1033 4904
Atomic Energy Research Establishment, Harwell, Berks
(England)
THE PRODUCTION OF PHOSPHORUS 32 FROM PILE-
IRRADIATED SULPHUR. W. J. Arrol and F. Hudswell,
comps. and eds. Oct. 1952. 21p. (AERE-I/R-1033)

UCRL-2182 4940
Radiation Lab., Univ. of Calif., Berkeley
QUADRUPOLE FOCUSING LENSES FOR CHARGED PARTI-
CLES. Bruce Cork and Emery Zajec. Apr. 15, 1953.
22p. (UCRL-2182)

AERE-I/R-1063 4849
Atomic Energy Research Establishment, Harwell, Berks
(England)
AN ISOTOPE HANDLING CALCULATOR. R. West. Apr.
30, 1953. 6p. (AERE-I/R-1063)

UCRL-2237 4886
Radiation Lab., Univ. of Calif., Berkeley
SCATTERING OF 190-MEV DEUTERONS ON PROTONS.
Arnold L. Bloom and Owen Chamberlain. June 4, 1953.
26p. (UCRL-2237)

AERE-M/R-1144 4805
Atomic Energy Research Establishment, Harwell, Berks
(England)
TRANSFORMATIONS BETWEEN HEXAGONAL AND BODY
CENTERED CUBIC LATTICES. PART 1. A CRYSTAL-
LOGRAPHIC STUDY OF POSSIBLE ORIENTATIONS. J. W.

UR-257 4709
Atomic Energy Project, Univ. of Rochester
THE RADIUM CONTENT OF PUBLIC WATER SUPPLIES.
John B. Hursh. May 4, 1953. 27p. (UR-257)

UR-258 4861
Atomic Energy Project, Univ. of Rochester
THE MEASUREMENT OF BREATH RADON BY CHARCOAL

- Glen. PART 2. SOME ASPECTS OF THE CRYSTAL-
LOGRAPHY OF ZIRCONIUM. S. F. Pugh. Feb. 1953. 34p.
(AERE-M/R-1144)
- AERE-M/R-1176 4730
Atomic Energy Research Establishment, Harwell, Berks
(England)
THE ANALYSIS OF FORMATION CURRENT IN ELECTRO-
LYTIC OXIDATION OF ZIRCONIUM. J. J. Polling and A.
Charlesby. Apr. 29, 1953. 16p. (AERE-M/R-1176)
- AERE-M/R-1184 4806
Atomic Energy Research Establishment, Harwell, Berks
(England)
THE METALLOGRAPHIC EXAMINATION OF HOT METAL
SURFACES. B. W. Mott and S. D. Ford. May 12, 1953.
10p. (AERE-M/R-1184)
- AERE-N/R-1159 4897
Atomic Energy Research Establishment, Harwell, Berks
(England)
BORON-CADMIUM INTERCALIBRATION FOR PILE NEU-
TRONS IN GLEEP. F. C. W. Colmer, E. R. Wiblin, and
W. B. Woollen. Mar. 19, 1953. 12p. (AERE-N/R-1159)
- AERE-T/R-1174 4898
Atomic Energy Research Establishment, Harwell, Berks
(England)
CRITICAL SIZE OF A SYSTEM INCLUDING A HYDROG-
ENOUS REFLECTOR. J. P. Elliott. Apr. 1953. 12p.
(AERE-T/R-1174)
- JENER-16 4900
Joint Establishment for Nuclear Energy Research (Norway)
DETERMINATION OF THE NEUTRON SPECTRUM BY
MEANS OF BORON ABSORPTION. Bertel Grimeland.
1953. 16p. (JENER-16)
- JENER-17 4901
Joint Establishment for Nuclear Energy Research (Norway)
Xe¹³⁵ POISONING OF THE JEEP. V. O. Eriksen and W.
Hålg. 1953. 22p. (JENER-17)
- NACA-RM-E53E04 4777
Lewis Flight Propulsion Lab., NACA
MEASUREMENTS OF HEAT-TRANSFER AND FRICTION
COEFFICIENTS FOR AIR FLOWING IN A TUBE OF
LENGTH-DIAMETER RATIO OF 15 AT HIGH SURFACE
TEMPERATURES. Walter F. Weiland and Warren H.
Lowdermilk. July 9, 1953. 19p. (NACA-RM-E53E04)
- NACA-TN-2933 4785
Lewis Flight Propulsion Lab., NACA
BEHAVIOR OF MATERIALS UNDER CONDITIONS OF
THERMAL STRESS. S. S. Manson. July 1953. 105p.
(NACA-TN-2933)
- NACA-TN-2973 4808
Lewis Flight Propulsion Lab., NACA
EFFECT OF PRESTRAINING ON RECRYSTALLIZATION
TEMPERATURE AND MECHANICAL PROPERTIES OF
COMMERCIAL, SINTERED, WROUGHT MOLYBDENUM.
Kenneth C. Dike and Roger A. Long. July 1953. 25p.
(NACA-TN-2973)
- NACA-TN-2974 4778
Lewis Flight Propulsion Lab., NACA
EXPERIMENTS ON MIXED-FREE-AND-FORCED-
CONVECTIVE HEAT TRANSFER CONNECTED WITH
TURBULENT FLOW THROUGH A SHORT TUBE. E. R. G.
Eckert, Anthony J. Diaguila, and Arthur N. Curren. July
1953. 59p. (NACA-TN-2974)
- NP-4363(suppl.) 4809
Battelle Memorial Inst.
TITANIUM BIBLIOGRAPHY, 1900-1951: 1952 SUPPLE-
MENT. Beverly J. Archer and Robert W. Gibson, comps.
1953. 55p. (NP-4363(suppl.))
- NP-4593(pt.1) 4828
Louisiana State Univ.
THEORY OF ELECTROLYSIS AT CONSTANT CURRENT
IN UNSTIRRED SOLUTION. 1. APPLICATION TO THE
STUDY OF COMPLEX IONS. Paul Delahay and Talivaldis
Berzins. Dec. 1952. 42p. (NP-4593(pt.1); Technical Re-
port 10)
- NP-4593(pt.2) 4829
Louisiana State Univ.
THEORY OF ELECTROLYSIS AT CONSTANT CURRENT IN
UNSTIRRED SOLUTION. 2. CONSECUTIVE ELECTRO-
CHEMICAL REACTIONS. Talivaldis Berzins and Paul
Delahay. Mar. 1953. 47p. (NP-4593(pt.2); Technical
Report 13)
- NP-4613 4810
Massachusetts Inst. of Tech.
1. FUNDAMENTAL DEFORMATION CHARACTERISTICS
OF 80 NICKEL-20 CHROMIUM ALLOY IN CREEP AT
ELEVATED TEMPERATURES. 2. AGING IN NICKEL-
CHROMIUM ALLOYS HARDENED WITH TITANIUM AND
ALUMINUM PERIODIC STATUS REPORT [FOR] FEBRU-
ARY 1953-MAY 1953. H. C. Chang, Rolf Nordheim, and
N. J. Grant. 4p. (NP-4613; Periodic Status Report 3)
- NP-4631 4879
Columbia Radiation Lab., Columbia Univ.
[MICROWAVE RESEARCH;] FIRST QUARTERLY PROGRESS
REPORT. Mar. 31, 1953. 32p. (NP-4631; CU-1-53-SC-
42519-Phys.)
- NP-4632 4811
Metals Research Lab., Graduate Div. of Applied Mathematics,
Brown Univ.
ULTRASONIC ATTENUATION AND VELOCITY MEASURE-
MENTS IN COMMERCIAL PURE TITANIUM BEFORE
AND AFTER HEATING IN HYDROGEN. Chung F. Ying and
Rohn Truell. May 1953. 51p. (NP-4632; Technical Report
1)
- NP-4635 4735
University of Southern Calif.
THE DIFFUSION AND SELF-DIFFUSION OF ELECTRO-
LYTES AND HYDRATION EFFECTS; TRANSPORT PROC-
ESS IN LIQUID SYSTEMS. Arthur W. Adamson. June
1953. 42p. (NP-4635; Technical Report 1)
- NP-4636 4748
Connecticut Univ.
TERNARY COMPOUNDS: SECOND TECHNICAL REPORT
FOR THE PERIOD JUNE 1, 1951 TO MAY 31, 1953. Roland
Ward, Beatrice Gushee, William McCarroll, and Dana H.
Ridgley. 22p. (NP-4636; Technical Report 2)
- NP-4637 4855
Institute of Rate Processes, Univ. of Utah
TABLES OF QUANTUM MECHANICAL INTEGRALS. 1.
SOME TWO PARAMETER INTEGRALS. C. J. Thorne,
R. S. Barker, and Henry Eyring. May 15, 1953. 38p.
(NP-4637; Technical Report 1)
- NP-4639 4779
Aeronautical Research Council, Rockets Sub-Committee
(Great Britain)
SOME EXPERIMENTS ON THE HEAT TRANSFER FROM A
GAS FLOWING THROUGH A CONVERGENT-DIVERGENT
NOZZLE. O. A. Saunders and P. H. Calder. Jan. 5, 1952.
13p. (NP-4639)
- NP-4641 4736
Institute of Industrial Research, Syracuse Univ.
NON-ELECTRONIC DOSE RATE INDICATING SYSTEMS:

- FOURTH QUARTERLY PROGRESS REPORT [FOR]
MARCH 15-JUNE 15, 1953. Henry Linschitz. 35p. (NP-4641; Quarterly Progress Report 4)
- NP-4642 4790
Pennsylvania State Coll. School of Mineral Industries
REFRACTORIES FOR USE IN HIGH TEMPERATURE
AREAS OF AIRCRAFT: BIMONTHLY PROGRESS REPORT.
W. H. Rice, E. A. Bush, N. R. Thielke, and W. R. Buessem.
Apr. 16, 1953. 47p. (NP-4642; Memo Report 18)
- NP-4643 4812
Horizons, Inc.
RATE OF DIFFUSION OF CARBON IN ALPHA AND IN
BETA TITANIUM AS A FUNCTION OF THE TEMPERA-
TURE AND CONCENTRATION; INTERIM TECHNICAL
REPORT [FOR] PERIOD DECEMBER 12, 1952-MARCH 11,
1953. Eugene Bucur and F. C. Wagner. Apr. 13, 1953.
21p. (NP-4643; Interim Technical Report 1)
- NP-4644 4860
Laboratory for Applied Biophysics, Mass. Inst. of Tech.
PHOTOGRAPHIC EFFECTS OF COUNTER DISCHARGES.
K. S. Lion and G. F. Vanderschmidt. May 1953. 67p.
(NP-4644)
- NP-4645 4830
Research Lab. of Electronics, Mass. Inst. of Tech.
QUARTERLY PROGRESS REPORT [FOR PERIOD ENDING
FEBRUARY 28, 1953]. J. B. Wiesner, G. G. Harvey, and
H. J. Zimmermann. Apr. 15, 1953. 104p. (NP-4645)
- NP-4646 4844
Servomechanisms Lab., Mass. Inst. of Tech.
ELECTRONIC NUCLEAR INSTRUMENTATION GROUP
ANNUAL PROGRESS REPORT [FOR PERIOD ENDING]
MARCH 1, 1953. T. S. Gray and A. B. Van Rennes. 60p.
(NP-4646)
- NP-4647 4803
Illinois Inst. of Tech.
THE EFFECT OF DISSOLVED ELEMENTS ON THE RATE
OF ISOTHERMAL GRAIN GROWTH IN METALS: FINAL
REPORT. S. C. Huang and J. M. Lommel. June 12, 1953.
38p. (NP-4647)
- NP-4648 4945
Stanford Univ.
INTERPRETATION OF ELECTRON SCATTERING EXPERI-
MENTS. L. I. Schiff. June 24, 1953. 21p. (NP-4648;
Technical Report 1)
- NP-4649 4786
Illinois Univ.
AN APPRAISAL OF THE PROT METHOD OF FATIGUE
TESTING. PART 2. H. T. Corten, Todor Dimoff, T. J.
Dolan, and Masaki Sugi. June 1953. 54p. (NP-4649;
Technical Report 35)
- NP-4651 4831
Applied Science Research Lab., Univ. of Cincinnati
THE SURFACE AREA OF CARBON BLACKS; A STUDY OF
POROUS MEDIA BY MEANS OF FLOW METHODS. Gerard
Kraus and John W. Ross. June 30, 1953. 23p. (NP-4651;
Technical Report 2)
- NP-4652 4752
Spectroscopy Lab., Ill. Inst. of Tech.
POTENTIAL CONSTANTS FOR DEUTERIUM AND HALOGEN
SUBSTITUTED METHANES [PROGRESS REPORT]; TECH-
NICAL REPORT ON MOLECULAR SPECTROSCOPY,
MOLECULAR STRUCTURE AND THERMODYNAMICS.
Submitted July 3, 1953. 12p. (NP-4652; Technical Report
14)
- NRL-Memo-170 4737
Naval Research Lab.
THERMAL AND RELATED PHYSICAL PROPERTIES OF
MOLTEN MATERIALS; PROGRESS REPORT [FOR]
PERIOD FEBRUARY 1, 1953 TO MAY 1, 1953. D. D.
Williams and C. T. Ewing. June 1, 1953. 10p. (NRL-
Memo-170; Progress Report 5)
- SUI-53-5 4832
Iowa State Univ.
INTEGRATED COSMIC RAY INTENSITY AS A FUNCTION
OF ALTITUDE (thesis). Ernest Clark Ray. June 1953.
51p. (SUI-53-5)
- TEI-316 4795
Geological Survey
THE OCCURRENCE OF MILLISITE AND PSEUDOWAVEL-
LITE IN THE LEACHED ZONE AT HOMELAND, FLORIDA.
J. P. Owens, R. Berman, and Z. S. Altschuler. Mar. 1953.
18p. (TEI-316)
- TEI-330 4796
Geological Survey
SEARCH FOR AND GEOLOGY OF RADIOACTIVE DEPOSITS:
SEMIANNUAL PROGRESS REPORT, DECEMBER 1, 1952 TO
MAY 31, 1953. June 1953. 302p. (TEI-330)
- WADC-TR-52-145 4815
Armour Research Foundation
EXPLORATION OF VANADIUM BASE ALLOYS. W. Ros-
toker, D. J. McPherson, and M. Hansen. May 1953. 66p.
(WADC-TR-52-145)
- WADC-TR-53-18(pt.1) 4816
Wright Air Development Center
POWDER-FABRICATED MAGNESIUM ALLOYS. PART 1.
DEVELOPMENT OF HIGH-STRENGTH SHEET FROM
POWDER-FABRICATED Mg ALLOYS CONTAINING Zn, Zr,
AND Al. H. A. Johnson, ed., Wright Air Development
Center and Dow Chemical Co. Jan. 1953. 116p. (WADC-
TR-53-18(pt.1))
- WADC-TR-53-18(pt.2) 4817
Wright Air Development Center
POWDER-FABRICATED MAGNESIUM ALLOYS. PART 2.
LARGE-SCALE EXTRUSION OF ZK60A ALLOY POWDER.
H. A. Johnson, ed., Wright Air Development Center and
Dow Chemical Co. Jan. 1953. 48p. (WADC-TR-53-18(pt.2))
- WAL-401/96-15 4818
Armour Research Foundation
BRAZING AND SOLDERING OF TITANIUM AND ITS AL-
LOYS: FINAL TECHNICAL REPORT [FOR] SEPTEMBER
1, 1951-JANUARY 31, 1953. 118p. (WAL-401/96-15)
- WAL-401/148-7 4819
Columbia Univ. School of Engineering
RESEARCH ON THE EFFECT OF PLASTIC DEFORMATION
ON TRANSFORMATION IN TITANIUM ALLOYS; INTERIM
TECHNICAL REPORT No. 1. Mar. 1953. 18p. (WAL-401/
148-7)

GENERAL

RESEARCH PROGRAMS

4701

Atomic Energy Commission

[SUMMARIES OF UNCLASSIFIED BASIC RESEARCH IN METALLURGY.] [Nov. 30, 1952] 47p. (TID-4005(pt.1))

Summaries are presented of 45 unclassified AEC basic-research contracts in the field of metallurgy that were active as of Nov. 30, 1952. (C.H.)

BIOLOGY AND MEDICINE

4702

Atomic Energy Project, Univ. of Rochester

THERMAL BURNS FROM THE ATOMIC BOMB. Herman E. Pearce and Harry D. Kingsley. Apr. 30, 1953. Decl. with deletions June 30, 1953. 43p. (AEC-D-3532; UR-254)

Primary thermal burns from the explosion of an atomic bomb are caused by brief exposure to intense radiant energy. Gross and microscopic evaluation of burn lesions produced by intense radiant energy from a carbon arc light and burning Mg have been carried out in the laboratory. Since the time of application, the intensity, and the spectrum of applied energy influence the character of the resultant lesion, it was necessary to compare the burns from an atomic bomb explosion to those produced in the laboratory. Experiments using anesthetized pigs and dogs were carried out at atomic bomb explosions and a range of thermal energies from 1.1 to 43 cal/cm² studied in respect to the skin effects. The time of burn production from various portions of the thermal pulse was determined by the use of various electrically operated shutters. The spectral effects of the bomb light were evaluated by the use of limiting filters over the exposed skin and also in front of calorimeters for measuring the energy causing the burns. Preliminary but inconclusive tests were made of the protective effects of certain fabrics. Some observations were obtained regarding the effects of combining ionizing radiation and burns. Sufficient data are obtained from the field to confirm and advance laboratory investigations of this type of burn. (auth)

4703

Cancer Research Inst., New England Deaconess Hospital, Boston

PHASE MICROSCOPY. Edna H. Tompkins. [1953] 7p. (AECU-2597)

Observations made on the rhythmic movement beneath the membrane of erythrocytes and measurements of the diameter of erythrocytes, made by means of the phase microscope, are discussed. The effect of suspending erythrocytes in saline, serum, or albumin, on the rhythmic movement is described. (C.H.)

4704

Academy of Natural Sciences of Philadelphia

SAVANNAH RIVER BIOLOGICAL SURVEY, JUNE 1951-MAY 1952. FINAL REPORT FOR E. I. DU PONT DE NEMOURS AND COMPANY, SAVANNAH RIVER PLANT. Feb. 1953. 330p. (AECU-2600)

A study of the aquatic life of the Savannah River was made during 1951-52. Extensive seasonal surveys were made of four regions on the Savannah River, and one on Upper Three Runs, a small tributary. Plants and animals are tabulated for each station for each of the four seasons studied. Histograms showing the number of species present in the various groups were made. From the pattern of the histograms and the kinds of species found, the river was determined to be in a healthy condition. (60 references.) (C.H.)

4705

Brookhaven National Lab.

METHOD OF CULTURE AND GROWTH OF MAIZE ENDOSPERM IN VITRO. Elizabeth Piecurs Sternheimer. [1952] 6p. (BNL-1434)

A method for the culture of maize endosperm tissues *in vitro* is described. A report is given of the growth of three strains of the cultured maize endosperm tissue which have been maintained from 1950 to 1953. (auth)

4706

Brookhaven National Lab.

SOLVATES OF CHLOROPHYLLS AND RELATED SUBSTANCES AND THEIR EQUILIBRIA. Simon Freed and Kenneth M. Sancier. [1953] 48p. (BNL-1499)

The spectrum of chlorophylls in dry hydrocarbon showed evidence of a thermally excited state about 1400 cal/mole above the ground state in agreement with the thermodynamic value derived from the variation of relative intensities of components with temperature. Solvation of chlorophylls corresponding to equilibria between zero- and mono-solvate and between mono- and di-solvate was found by varying the temperature and concentration of various polar substances in the solvents. An effort to determine at what part of the chlorophyll molecule solvation took place is reported, and comparison is made with studies of solvates of pheophytin. (C.H.)

4707

Brookhaven National Lab.

ON THE EXISTENCE OF THREE OR MORE CHLOROPHYLLS b. Simon Freed and Kenneth M. Sancier. [1952] 10p. (BNL-1500)

Preparations of chlorophylls which had the same absorption spectra at room temperature exhibited different spectra at low temperatures. The origin of the difference was in the temperature dependence of equilibria between the two forms present in polar solutions of each preparation. The equilibria of any given preparation proved to be reproducible and were easily characterized by the temperature at which corresponding absorption maxima of the two forms had the same height. Thirteen of fourteen preparations of chlorophyll b and chlorophyll b' distributed themselves among three characteristic temperatures. The existence of these different chlorophylls seems to be in part traceable to the origin of

spinach from which they were extracted. Chlorophyll *a* also seemed to have similar properties but was not studied as extensively as was chlorophyll *b* because of the greater difficulty of resolving the forms in equilibrium. Possible structural formulas of chlorophyll *b* are discussed to account for the varieties which have appeared. (auth)

4708

Oak Ridge Inst. of Nuclear Studies

QUARTERLY PROGRESS REPORT [FOR] JANUARY 1-MARCH 31, 1953. 30p. (ORO-97)

This report is essentially administrative in scope. Educational activities for the period are summarized. Abstracts are included of articles which have been published, or accepted for publication, written by members of the medical division staff. A preliminary report is presented on the use of the scintiscanner in studying the distribution of Au^{198} in cancer patients. (For preceding period see ORO-88.) (C.H.)

4709

Atomic Energy Project, Univ. of Rochester

THE RADIUM CONTENT OF PUBLIC WATER SUPPLIES.

John B. Hursh. May 4, 1953. 27p. (UR-257)

The Ra concentration of the source of raw water used by 41 cities in the U.S., constituting one-fifth of the total population, has been found to range from 0 to 65×10^{-16} g Ra/ml water. Of all the supplies measured only four showed concentrations more than 5×10^{-16} g Ra/ml. Measurement of the corresponding tap water revealed a range of Ra concentration (excepting one value) of 0 to 1.7×10^{-16} g. Ra/ml with an average value of 0.42×10^{-16} . The exception was the tap water of Joliet, Illinois, measured as 58×10^{-16} . The data are regarded as generally indicating that ground water sources, deep wells in particular, contain a higher Ra concentration than surface sources. The Mississippi, Missouri, and Allegheny Rivers are exceptions to this generalization and show relatively high Ra levels. The average value of 0.42×10^{-16} g Ra/ml tap water is not significantly different from the Ra concentration in Rochester tap water, lending support to the inference that the measurements of Ra content of human subjects who lived in that vicinity may furnish values representative of a much larger population group. (auth)

AEROSOLS

4710

PROPERTIES, TOLERANCE DOSES, AND DETERMINATION OF AEROSOLS HAVING α RADIOACTIVITY. Georgette Delibrias and Jacques Labeyrie. *J. phys. radium* **14**, 407-18 (1953) June. (In French)

The principal properties of α -active aerosols are described and the tolerance doses indicated. Two methods used by the French Atomic Energy Commission for the determination of aerosols are discussed. The methods consist of collecting the aerosol upon a filter and measuring the α radiation, either by proportional counting (Geiger or scintillation counter) or by radioautography. In the case of aerosols of elements with long periods, the sensitivity limit with the last method is of the order of $1/10,000$ of the tolerance dose for U and Po and of the order of $1.4/1000$ of the tolerance dose for Ra and Pu. For the first method, the limits are lower. (tr-auth)

RADIATION EFFECTS

4711

Argonne National Lab.

BIOLOGICAL AND MEDICAL RESEARCH, RADIOLOGICAL PHYSICS, AND HEALTH SERVICES DIVISIONS MONTHLY PROGRESS REPORT [FOR] JUNE 1953. July 1953. 20p. (ANL-5086)

Brief statements are presented on the status of work in the above Divisions. (For preceding period see ANL-5013.) (C.H.)

4712

X-RAY INACTIVATION OF POLYPLOID SACCHAROMYCES.

W. H. Lucke and A. Sarachek. *Nature* **171**, 1014-15 (1953) June 6.

A comparison of the average survival curves, following irradiation, for haploid, diploid, triploid, and tetraploid yeast indicate clearly a one to one correspondence between the degree of polyploidy and the number of targets per cell. Interpretation of the survival curves on a multi-target basis is discussed. (C.H.)

4713

TOTAL STERILIZATION OF THE GONADS AFTER TREATMENT WITH RADIOACTIVE PHOSPHORUS, IN THE CYPRINODONTIS: *LEBISTES* AND *XIPHAPHORES*. Jean Vivien. *Compt. rend.* **236**, 2172-4 (1953) June 1. (In French)

(cf. NSA 7-1877)

Adult fish were kept in water of decreasing radioactivity and on the 8th day were removed to normal water. Young fish, less than 1 month old, were kept in radioactive water. Autopsies were performed 100 to 130 days after the start of exposure. The adult fish had undergone a complete degeneration of the germinal elements and a resorption of mature gametogenic elements. The young fish had not shown any gametogenic growth and their reserve of germinal cells had been completely destroyed. The secondary sexual characteristics developed at the normal age. (J.S.R.)

4714

EFFECT OF WHOLE BODY X-IRRADIATION ON NATURAL INHIBITOR OF CARBOXYPEPTIDASE. Robert N. Feinstein and John C. Ballin. *Proc. Soc. Exptl. Biol. Med.* **83**, 8-10 (1953) May.

Whole-body x irradiation of mice, rats, and rabbits at the LD₅₀ range increases the activity of certain tissue cathepsins. Liver, kidney, and intestine were the tissues tested, and it was found that one of 3 liver cathepsins, 2 of the same 3 cathepsins in kidney, and 2 of the 3 in intestine were increased in activity by the radiation. This appears due, at least in the case of rat kidney carboxypeptidase, to the destruction by the x rays of an enzyme inhibitor. It is possible that the source of all inhibitor found in tissues and blood alike is the blood cell, probably the leukocyte. The possibility is suggested that the reduction of carboxypeptidase inhibitor in blood cells may serve as a basis for determining, within 24 hours of the exposure, whether or not an individual has received a lethal dose of ionizing radiation. (auth)

4715

SUPPRESSION OF NORMAL BACTERICIDAL ACTION OF RABBIT SERUM FOLLOWING WHOLE BODY X-IRRADIATION. Stanley Marcus and David M. Donaldson. *Proc. Soc. Exptl. Biol. Med.* **83**, 184-7 (1953) May.

Whole-body x irradiation of 650 to 725 r results in depression of the normal bactericidal activity of rabbit serum. With the x-irradiation doses employed, the bactericidal action of serum from rabbits is normal on the first post-irradiation day, is depressed by the fifth day following whole-body x irradiation and returns in surviving animals by the twentieth post-irradiation day. Following a second dose of 650 r, serum bactericidal activity is depressed for a longer time than after the first 650 r x-irradiation exposure. (auth)

RADIATION HAZARDS AND PROTECTION

4716

[Cancer Research Inst.], New England Deaconess Hospital, Boston

RADIOISOTOPES IN THE HOSPITAL. R. F. Cowing and Shields Warren. [1953] 10p. (AECU-2598)

Precautions to be observed by the staff of hospitals using radioisotopes to insure the safety of other personnel and of the public are reviewed. The procedure for obtaining radioisotopes for medical use from the Atomic Energy Commission is outlined. Precautions to be taken to prevent external exposure, ingestion or inhalation of radioactive material, and contamination by spilling or spreading of radioactive materials are discussed. The problem of waste disposal is discussed briefly. (C.H.)

4717

Atomic Energy Project, Univ. of Calif., Los Angeles
THE AVAILABILITY OF RADIO-STRONTIUM TO MAMMALS BY WAY OF THE FOOD CHAIN. Warren J. Gross, Janice F. Taylor, Joshua A. Lee, and James C. Watson. Issued June 18, 1953. 26p. (UCLA-259)

Sr^{90} is selectively metabolized by rats when ingested in the form of barley or lettuce grown on $\text{Sr}^{90} + \text{Y}^{90}$ contaminated soil. Aggregation occurs in the tissues (mainly skeletal) when such doses are administered at the rate of 500 to 1000 dis/sec/day. Deposition from contaminated plant material is less than from equal doses of $\text{Sr}^{90} + \text{Y}^{90}$ in aqueous solution. The rate of deposition of Sr^{90} from equal daily oral doses of $\text{Sr}^{90} + \text{Y}^{90}$ decreases with time during a prolonged feeding experiment. Thus young rats fed daily $\text{Sr}^{90} + \text{Y}^{90}$ in solution over a seven-day period retained 7.9% total dose while young rats given daily doses of $\text{Sr}^{90} + \text{Y}^{90}$ over a seventeen-week period retained only 1.8% total dose. The amount of Sr^{90} deposited from oral doses is influenced little, if any, by the amount of stable Sr in the diet at the time of the Sr^{90} ingestion. Stable Sr, however, apparently effects the release of deposited Sr^{90} from the tissues when it is administered orally in massive doses ten days following the ingestion of Sr^{90} . This suggests stable Sr as a therapeutic agent. No radiation effects are identified in any of the experimental animals even in the extreme case where rats were given daily doses of $\text{Sr}^{90} + \text{Y}^{90}$ of 2733 dis/sec over a seventeen-week period. A method for predicting the maximum level of retention under a given set of conditions for any radioisotope of any physiological element is discussed. Rats fed $\text{Sr}^{90} + \text{Y}^{90}$ over a seventeen-week period with the daily dose of 2733 dis/sec for a cumulative dose of 431,000 dis/sec averaged a retention of 5976 dis/sec or sixty-six % of the calculated maximum. The observed retention after thirty daily doses of 688 dis/sec was 2293 dis/sec, also sixty-six % of the calculated maximum. (auth)

4718

SAMPLING AND MEASUREMENT OF AIRBORNE DAUGHTER PRODUCTS OF RADON. John H. Harley. Nucleonics 11, No. 7, 12-15(1953) July.

A method for simple, rapid determination of Rn and its daughters for concentrations as low as 5×10^{-15} c/l is described, based on the correlation between the Rn concentration in the air and the activity of the short-lived Rn daughter products. (L.T.W.)

4719

FIELD EQUIPMENT FOR THE COLLECTION AND EVALUATION OF TOXIC AND RADIOACTIVE CONTAMINANTS. W. B. Harris, H. D. LeVine, and M. Eisenbud. Arch. Ind. Hyg. and Occupational Med. 7, 490-502(1953) June.

Field equipment for the collection and evaluation of toxic and radioactive air contaminants is described. A sampling pump, volt sampler, filter-paper holder, cascade impactor, high-volume air sampler, β filter-paper meter, and Rn sampler are described. (C.H.)

4720

CONTRIBUTIONS TO THE ENZYMOLOGY OF THE NORMAL AND CATARACTOUS LENS. III. ON THE CATALASE

OF THE CRYSTALLINE LENS. E. A. Zeller. Am. J. Ophthalmol. 36, 51-3(1953) June.

In the lens of three species, a definite but very small amount of hydrogen peroxide-decomposing capacity was found. The agent responsible for this reaction is heat-labile, does not dialyze through membranes and is blocked by typical catalase inhibitors. Thus, if hydrogen peroxide were produced in the lens in the course of ionizing irradiation, little protection to this organ can be given by its catalase. (auth)

RADIOTHERAPY

4721

THE TREATMENT OF CANCER WITH RADIOISOTOPES. John R. Sampey. Ind. Med. Surg. 22, 300-1(1953) July.

Clinical applications of radioisotopes in the treatment of cancer are briefly summarized. (C.H.)

TOXICOLOGY STUDIES

4722

Atomic Energy Project, Univ. of Rochester
PRESENT STATUS OF POLONIUM TOLERANCE ESTIMATIONS. J. B. Hursh and J. N. Stannard. Oct. 14, 1948
Decl. with deletions June 1, 1953. 33p. (AECD-3539; UR-44)

A summary of biological information on distribution, excretion, and toxicity of Po is presented. A comparison is made of results obtained when maximum permissible exposure rates for man are calculated from available data by different methods, and a critical evaluation is made of the present status of Po tolerance estimates. A maximum permissible body content of the order of 0.2 μc /70-kg man is obtained by two methods. Applying a urinary excretion rate of 0.1% of body content/day, effective half life of 34 days, and certain corrections for the non-exponential nature of Po excretion, maximum permissible air and water concentrations, and urinary excretion rates have been computed. Extrapolation from present data to calculations of tolerance levels in man is still difficult, and there appears to be no substitute for actual long-term experiments. On the other hand, permissible exposure levels quoted herein appear to be, to a large extent, consistent with conservative practice. (auth)

TRACER APPLICATIONS

4723

Brookhaven National Lab.
THE COMPARTMENTATION AND KINETICS OF BODY WATER. James S. Robertson. [1952] 8p. (BNL-1439)
The advantages of utilizing tracer water in body-water studies are reviewed. Some applications of the methods in determining the compartmentation and kinetics of body water are discussed. (C.H.)

4724

Brookhaven National Lab.
THE EFFECT OF VARIATIONS OF SODIUM INTAKE AND OF DESOXYCORTICOSTERONE ON THE RELATIONSHIP OF THE SODIUM SPACE TO THE CHLORIDE SPACE IN DOGS. J. L. Gamble, Jr. [1953] 27p. (BNL-1478)

The relation of the Na space to that of chloride was studied in the dog under conditions of abnormal Na metabolism. Variations of the Na intake from 0.5 meq/kg a day to 20 meq/kg a day did not produce a significant relative enlargement of the Na space. Measurements on puppies whose growth had been arrested when they were offered only low-Na milk did not differ from control values. Infusions of NaHCO_3 (12 meq/kg in 3 hr) produced an increase of only 2 to 3% of the $\text{Na}^{24}:\text{Cl}^{38}$ space ratio while an infu-

sion of HCl (7 meq/kg in 3 hr) caused a decrease of 5%. Daily injection of desoxycorticosterone acetate (3 mgm/kg a day) combined with a moderately high Na intake (6 meq/kg a day) for 17 days brought about a 12% increase in this space ratio. The significance of these findings with reference to changes of intracellular Na is discussed. (auth)

4725

Brookhaven National Lab.

PHENYLALANINE AND TYROSINE UTILIZATION IN NORMAL AND PHENYLALANINE-DEFICIENT YOUNG MICE. C. R. Grau and Robert Steele. [1952] 24p. (BNL-1495)

Young mice were maintained on normal or phenylalanine-deficient diets in which tyrosine and other amino acids were adequately supplied. Meals of similar composition but containing uniformly labeled C^{14} -L-phenylalanine or C^{14} -L-tyrosine were fed, expired $C^{14}O_2$ was collected and measured for 30 min, and the animals were then killed. Tyrosine and phenylalanine were isolated from the liver proteins and their C^{14} contents were determined. Mice fed the phenylalanine-deficient diet converted less of the absorbed phenylalanine to liver protein tyrosine and less to CO_2 than did the animals fed the diet containing enough phenylalanine for normal growth. A phenylalanine-deficient mouse treated the phenylalanine of a test meal of adequate phenylalanine content in about the same way as did the normal mouse. A normally-fed mouse treated the phenylalanine of a test meal of deficient phenylalanine content in a way approaching the response of the phenylalanine-deficient mouse. Absorbed C^{14} -L-tyrosine was not converted to liver protein phenylalanine by either the normal or phenylalanine-deficient mouse. (auth)

4726

Atomic Energy Project, Univ. of Rochester
PRODUCTION OF PLASMA AND TISSUE PROTEINS BY NON-HEPATIC RAT ORGANS AS STUDIED WITH LYSINE- ϵ - C^{14} . C. G. Bly, L. L. Miller, and W. F. Bale. May 26, 1953. 47p. (UR-259)

The non-hepatic tissue in a perfused rat carcass was found to maintain some physiological functions for 5 to 6 hr of perfusion, including tissue protein synthesis and good clearance of lysine- ϵ - C^{14} and glucose from the perfusate. The perfused carcass tissues were found to incorporate small amounts of lysine- ϵ - C^{14} into the globulin fraction only of plasma protein. In the perfused carcass, transplanted growing Walker carcinoma appeared to synthesize tissue protein very poorly. (C.H.)

4727

RADIOISOTOPE PROCEDURES WITH LABORATORY ANIMALS. Sam L. Hansard and C. L. Comar. *Nucleonics* 11, No. 7, 44-7(1953) July.

Procedures are described for the administration of radioisotopes to small laboratory animals and for the care and handling of animals following the administration of radioisotopes. Methods for the separate collection of feces and urine and for the collection of expired gases are described. 49 references. (C.H.)

CHEMISTRY

4728

Foundation for Industrial Research, Univ. of Wichita
THE PERMEABILITY METHOD OF DETERMINING SURFACE AREAS OF FINELY DIVIDED MATERIALS. May 1, 1953. 111p. (AECU-2591; Report 2)

The theory and experimental techniques used in the method were previously outlined and are only briefly reviewed here. Data and results are presented from experiments on the following: (1) metal powders and cements, (2) carbon blacks, (3) porous glass, and (4) porous media of extremely low surface area (fritted glass disk and alundum porous disks). Permeability gases used included He, air, N_2 , and CO_2 . In some cases N_2 adsorption-desorption isotherms were made as checks on the results. (For preceding report in series see AECU-1409.) (L.M.T.)

4729

Noyes Chemical Lab., Univ. of Ill.

INTERMOLECULAR CARBON ISOTOPE EFFECT IN THE DECARBOXYLATION OF NORMAL MALONIC ACID IN QUINOLINE SOLUTION. Peter E. Yankwich and R. Linn Belford. [1953] 18p. (AECU-2596)

Previous experiments on the C isotope effect in the decarboxylation of malonic acid in H_2SO_4 produced a strongly curvilinear plot of isotope effect vs. the reciprocal of the temperature, whereas a linear plot is predicted by calculations based on the Bigeleisen model. In order to explain this apparent discrepancy, isotope-effect results for malonic acid decarboxylation in quinoline solution are presented. (L.T.W.)

4730

Atomic Energy Research Establishment, Harwell, Berks (England)

THE ANALYSIS OF FORMATION CURRENT IN ELECTROLYTIC OXIDATION OF ZIRCONIUM. J. J. Polling and A. Charlesby. Apr. 29, 1953. 16p. (AERE-M/R-1176)

When Zr is oxidized electrolytically, not all the charge passed corresponds to the thickness of the oxide film produced. It is therefore assumed that the formation current consists of both ion and electron components, only the former producing film growth. In this paper these are measured separately. The electron current is determined from the rate of evolution of oxygen. If the remainder of the total current is ionic, there should result a weight increase of $0.46 \mu g/cm^2/v$, due to oxidation. The ionic current is deduced from the observed weight increase. After correction for dissolution of Zr and for the trapping of volatile compounds within the film, a figure of $0.41 \mu g/cm^2/v$ is deduced for the film growth. The agreement between these two values, which is within experimental error, shows that the basic assumption, that both electron and ion currents flow, is correct. From the results the current efficiency, rate of formation, dielectric constant, and film thickness are obtained. Under the conditions of the experiment this amounts to 30 A per volt. (auth)

4731

Argonne National Lab.

DISSOLUTION OF ZIRCONIUM IN HYDROFLUORIC ACID. John E. Baumrucker. Mar. 31, 1950. 18p. (ANL-5020)

Tests were made on the dissolution rate in HF solution of Zr metal produced by both Mg reduction and iodide decomposition. Metal fabricated from crystal bar dissolved at a slightly greater rate than that made from Mg-reduced sponge. An aqueous 5%, by volume, solution of HF was found to give the best results. However, results favorable to a desired use of this method for diffusion studies by remote control on irradiated material were not obtained. (auth)

4732

Brookhaven National Lab.

INHIBITORY EFFECT OF AROMATIC ACIDS ON THE D-AMINO ACID OXIDASE. J. Raymond Klein. [1953] 19p. (BNL-1482)

A number of heterocyclic acids having aromatic properties were found to inhibit the D-amino acid oxidase by competing

with the substrate. It appears likely that such inhibition will in some degree be exhibited by all such acids. Certain of such inhibitors, namely those with the acid group attached to the ring, in addition to the negative charge attributable to the acid group, bear a positive charge arising from resonance. This suggests analogy to the similar charges of the amino acids and, therefore, like attachment of amino acids and inhibitors to the oxidase. (auth)

4733

Brookhaven National Lab.

TEMPERATURE INDEPENDENT FACTOR IN THE RELATIVE RATES OF ISOTOPIC THREE CENTER REACTIONS. Jacob Bigeleisen and Max Wolfsberg. [1953] 11p. (BNL-1486)

It is shown that the theoretical equation for the ratio of the rate constants of isotopic molecules is essentially independent of whether the crossing of the barrier is treated as a translation or a vibration. The temperature-independent factor in this equation is evaluated for the case of substitution or displacement reactions. Calculations are presented for several cases involving the isotopes of C where there is simultaneous bond rupture and bond formation. (auth)

4734

Ames Lab.

REACTION OF IRON(II) WITH 1,2-CYCLOHEXANEDIONEDIOXIME IN ACID SOLUTION. Charles V. Banks and Elaine K. Byrd. [Apr. 8, 1953.] 18p. (ISC-333)

Information about a decomposition of 1,2-cyclohexanedione dioxime in 0.1N acid has been presented. A spectrophotometric study of the reaction of Fe(II) with 1,2-cyclohexanedione dioxime in dilute, acetate-buffered solutions containing no ammonia or amine has been reported. The ratio of 1,2-cyclohexanedione dioxime to Fe(II) was found to be 2:1 by Job's method. The solid compound formed when an excess of 1,2-cyclohexanedione dioxime is added to more concentrated Fe(II) solutions has been studied. Analysis of the vacuum-dried solid is in agreement with the theoretical composition of the compound $\text{Fe}(\text{DH})_2 \cdot 2\text{H}_2\text{O}$. (auth)

4735

University of Southern Calif.

THE DIFFUSION AND SELF-DIFFUSION OF ELECTROLYTES AND HYDRATION EFFECTS; TRANSPORT PROCESSES IN LIQUID SYSTEMS. Arthur W. Adamson. June 1953. 42p. (NP-4635; Technical Report 1)

The existing theoretical explanations of the concentration dependence of the mean diffusion coefficients of electrolytes and of the self-diffusion coefficients of ions are examined in the light of current data. Inadequacies in the mathematical approximations made in the electrophoretic effect treatment of mean diffusion coefficients are discussed, and it is shown that, even after allowing for these agreements with present data is poor. A possible additional effect, arising from the counter diffusion of solvent, is discussed. This second approach yields hydrodynamic radii for electrolytes which are quite large and, in concentrated solutions, tend to approach (as an upper limit) the atmosphere radius. The mathematical basis for the relaxation effect computed for the self-diffusion of ions is outlined. An alternative theory based on the absolute rate treatment of diffusion is presented. It is found, however, that the present self-diffusion data are insufficiently precise for adequate testing of limiting laws, and that, in concentrated solutions, systematic differences appear to exist between the various experimental methods employed. (auth)

4736

Institute of Industrial Research, Syracuse Univ.

NON-ELECTRONIC DOSE RATE INDICATING SYSTEMS: FOURTH QUARTERLY PROGRESS REPORT [FOR] MARCH 15-JUNE 15, 1953. Henry Linschitz. 35p. (NP-

4641; Quarterly Progress Report 4)

The results of continued work on the state and reactions of solvated electrons in certain rigid solvents are reported here. Light-induced changes in the absorption spectra of metal-amine glasses are interpreted on the basis of possible trap structures. The process of photo-ionization of certain organic molecules, leading to the formation of radicals and solvated electrons, is established by demonstrating the presence of both products in illuminated glasses. It is shown that recombination of these electrons and radicals leads to the formation of excited triplet states of the original molecule. However, x irradiation of these same glasses does not result in stable solvated electrons, so that this technique cannot be used to measure the initial ion yield in these solvents. (For preceding period see NP-4556.) (auth)

4737

Naval Research Lab.

THERMAL AND RELATED PHYSICAL PROPERTIES OF MOLTEN MATERIALS; PROGRESS REPORT [FOR] PERIOD FEBRUARY 1, 1953 TO MAY 1, 1953. D. D. Williams and C. T. Ewing. June 1, 1953. 10p. (NRL-Memo-170; Progress Report 5)

Further studies of reactions of NaOH with container materials are reported. Some measurements on diffusion of H_2 through thin-walled Ni tubes are given. The thermal conductivity measurements of Li metal are being replaced on the schedule with measurements on MoSi_2 , for which apparatus is essentially complete. (auth)

4738

Metals Research Lab., Carnegie Inst. of Tech.

ELECTROCHEMICAL STUDIES OF NON-AQUEOUS MELTS: QUARTERLY PROGRESS REPORT [FOR] PERIOD ENDING JUNE 15, 1953. Robert F. Mehl and Gerhard Derge. July 10, 1953. 15p. (NYO-3694)

The Cu/S ratio in fused Cu_2S has been varied by addition of CuS. This causes a marked decrease in both the specific conductance and positive temperature coefficient of specific conductance of the system. Preliminary results indicate that addition of Cu to the stoichiometric composition also reduces the conductance. These results indicate a pseudo-metallic structure in the melt rather than ionic. Additional data support the evidence that the transport number of Fe ions in silica-saturated FeO-SiO_2 is nearly one, i.e., all the ionic current is being carried by this ion. A special Pt anode was designed to measure O_2 solution at this electrode by oxidation of Fe. Results show that silicate ion is oxidized to evolve O_2 and deposit SiO_2 at the anode. (For preceding period see NYO-3693.) (auth)

4739

THE USE OF AROMATIC COMPOUNDS OF ARSENIC IN CHEMICAL ANALYSIS, PART 1. A. I. Portnov. Translated by V. L. Skitsky, from *Zhur. Obshchei Khim.* 18, 594-600 (1948). 19p. (TEI-324)

The purpose of this study is to evaluate the analytical properties of aromatic arsonic acids and thus to establish a basis for their broader utilization in chemical analysis. The constants of dissociation have been determined for the phenylarsonic, arsanilic, acetarsanilic, p-oxyphenylarsonic, p-methylphenylarsonic, o-nitrophenylarsonic, m-nitrophenylarsonic, and p-nitrophenylarsonic acids. A study has been made of the effects of the replacing radicals on the constants of dissociation of arsonic acids. The conditions of the precipitation of a number of cations by means of arsonic acids were investigated. The dependence of the solubility of salts of arsonic acids upon the polarizing effects of replacing radicals was brought to light. (auth)

4740

THE REACTIONS OF ALUMINUM WITH WATER. L. Lepin, A. Teter, and A. Shmit. *Doklady Akad. Nauk S.S.S.R.* 88,

871-4(1953) Feb. 11. (In Russian)

The reaction of Al with water is investigated in the temperature range from 0 to 100°C. Colloidal Al was used and the experiment conducted in an atmosphere of H, free of O traces. The kinetics of the reaction are graphed against time. The probable mechanism of the reaction is given. (J.S.R.)

4741

THE HEAT OF FORMATION OF BERYLLIUM OXIDE.

Lee A. Cosgrove and Paul E. Snyder. *J. Am. Chem. Soc.* **75**, 3102-3(1953) July.

The heat of formation of BeO has been redetermined by means of the precision O bomb calorimeter. The material burned consisted of high-purity foil about two mils thick. Because of the high temperatures involved, the combustion was performed in beryllia crucibles. The results of this investigation yielded a value of -143.1 ± 0.1 kcal/mole for the standard heat of formation of the above compound. (auth)

4742

LOW TEMPERATURE HEAT CAPACITIES OF INORGANIC SOLIDS. XVII. HEAT CAPACITY OF TITANIUM FROM 15 TO 305°K. Charles W. Kothen and Herrick L. Johnston. *J. Am. Chem. Soc.* **75**, 3101-2(1953) July.

The heat capacities of Ti have been measured in the temperature range 15 to 305°K, and the derived thermal functions have been calculated and tabulated at integral values of the temperature over this range. The entropy at 298.16°K is 7.33 ± 0.02 e.u. (auth)

4743

THE REACTIONS OF METHYL RADICALS WITH THE HYDROGEN ISOTOPES. E. Whittle and E. W. R. Steacie. *J. Chem. Phys.* **21**, 993-9(1953) June.

The photolysis of acetone has been studied in the temperature range 130 to 420°C. Measurements have been made of the rates of most of the possible reactions of CH_3 and CD_3 radicals with hydrogen, deuterium, and deuterium hydride. The following activation energies for the abstraction of a hydrogen or deuterium atom have been found: CH_3 + acetone, 9.7; CD_3 + d acetone, 11.6; CH_3 + D_2 , 11.8; CD_3 + H_2 , 11.1; CH_3 + HD — CH_4 , 10.0; CH_3 + HD — CH_3D , 11.3; CD_3 + HD — CD_3H , 10.7; CD_3 + HD — CD_4 , 10.7 kcal. The steric factors are all of the order of 10^{-3} . The results are discussed in terms of isotope effects with particular reference to the deuterium hydride reactions. (auth)

4744

STABILITY OF SIMPLE POSITRON COMPOUNDS. Aadne Ore. *Univ. Bergen Årbok, Naturvitenskap. Rekke*, Paper No. 5(1952) 32p.

The possible dynamic stability of certain positron compounds is investigated variationally. The systems at issue consist of one or more electrons, one ordinary atomic nucleus, and one positron. The merits of various types of trial wave functions are compared. The particular positron compound $e^+\text{H}^-$, the positronium hydride molecule, is studied extensively. The paper includes the calculations which have been reported previously to establish the dynamic stability of this structure, by yielding the lower limit of approximately 0.07 eV to the dissociation energy. The method of calculation employed in this case is essentially the one which has been known to suffice for establishing the stability of the positronium molecule. This method was previously described in a but very sketchy manner and in a way which did not reveal its full range of applicability. For these reasons the method is presented in much detail. (auth)

ANALYTICAL PROCEDURES

4745

Atomic Energy Research Establishment, Harwell, Berks (England)

A RAPID METHOD FOR THE SEMI-QUANTITATIVE SPECTROGRAPHIC ANALYSIS OF A WIDE RANGE OF MATERIALS. F. T. Birks. May 6, 1953. 7p. (AERE-C/R-1177)

The material without any pretreatment is arced in graphite electrodes with a covering layer of graphite powder. The photographic region 2000 to 8000 Å is covered in a single exposure by the use of Ilford long range spectrum plates in the Hilger medium quartz spectrograph. Thirty-seven elements are determined with high sensitivity to a factor of 2. (auth)

4746

Ames Lab.

TITRIMETRIC DETERMINATION OF THORIUM. James S. Fritz and John J. Ford. Jan. 1, 1953. 11p. (ISC-304)

The present method consists of a direct titration of Th with a standard solution of disodium (ethylenediamine)tetraacetate (Versene), a soluble complex being formed. An internal indicator gives a sharp, reversible color change at the end point. The titration is carried out in acid solution where comparatively few cations form Versene complexes of sufficient strength to cause interference. Th can be conveniently separated from most interfering cations and anions by a preliminary extraction with mesityl oxide (AECD-3186). When this separation is followed by a Versene titration, the result is a rapid and widely applicable analytical method for Th. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

4747

Ames Lab.

COMPOUNDS OF THORIUM WITH TRANSITION METALS OF THE FIRST PERIOD. 2. THE THORIUM-IRON, THORIUM-COBALT AND THORIUM-NICKEL SYSTEMS. John Victor Florio and R. E. Rundle. June 1, 1952. 54p. (ISC-273)

The composition and structure of the phases obtainable at room temperature in the binary systems of Th with the transition metals of the first period have been determined by x-ray-diffraction methods. The compositions of these intermetallic compounds bear little relation to the customary valences of the metals. Attempts to correlate these compounds with one another and with intermetallic compounds in general have been based essentially upon a consideration of the relative values of metallic radii and upon the ratio of valence electrons to atomic nuclei. A study of the Laves phases, common to many compounds with the formula AB_2 and a radius ratio of approximately 1.25, suggests that it is the A-B distance which determines the size of the polyhedra comprising the unit cell. Inspection of the lattices and coordination polyhedra of the compounds, ThMn_{12} , $\text{Th}_2\text{Fe}_{17}$, $\text{Th}_2\text{Co}_{17}$, $\text{Th}_2\text{Ni}_{17}$ and ThNi_5 , shows that they are related to one another though the compounds belong to different crystal classes. It appears that the compounds, ThMn_{12} , $\text{Th}_2\text{Mn}_{23}$ and ThMn_2 , are related to the Hume-Rothery β , γ , and ϵ phases, with electron to atom ratios of 1.5, 1.615, and 1.75 on the basis of Hume-Rothery's valences or with the ratios of 4.94, 4.82, and 4.69 on the basis of Pauling's valences. However, only Pauling's ratios give a consistent value for the valence of Mn. It also appears probable that the compounds in the Th-Fe, Th-Co, and Th-Ni systems are Hume-Rothery-type compounds. (auth)

4748

Connecticut Univ.

TERNARY COMPOUNDS: SECOND TECHNICAL REPORT FOR THE PERIOD JUNE 1, 1951 TO MAY 31, 1953. Roland Ward, Beatrice Gushee, William McCarroll, and Dana H. Ridgley. 22p. (NP-4636; Technical Report 2)

Correlation has been found among ternary oxides of Mn,

Fe, Co, and Ni. The compounds $\text{Ba}_3\text{Fe}_2\text{O}_{22}$, $\text{BaCoO}_{2.72}$, and BaNiO_3 have been shown to have very closely related structures. Other new phases with related structures occur in these systems at higher temperatures, and in the systems Sr-Fe-O, Sr-Co-O, Sr-Ni-O, and Sr-Mn-O. Unidentified crystalline products were obtained in the systems Ca-Cr-O, Sr-Cr-O, Ba-Cr-O, and Ba-Cu-O. Three series of compounds very similar in structure have been found for the rare earth elements with V, Cr, and Co. Nb and Ta compounds with Ba and Sr show interesting properties and some similarities to the W bronzes. Three crystalline phases have been isolated from fused mixtures of Na tungstate, W(VI) oxide and Mo(VI) oxide. One of these phases has the approximate composition $\text{Na}_{0.34}\text{Mo}_{0.14}\text{W}_{0.83}\text{O}_3$. (For preceding period see NP-3915.) (auth)

FLUORINE AND FLUORINE COMPOUNDS

4749

THE TRANSMITTANCE OF CRYSTALLINE CADMIUM FLUORIDE. H. M. Haendler, C. M. Wheeler, Jr., and W. J. Bernard. *J. Opt. Soc. Amer.* 43, 215-16(1953) Mar.

The successful preparation of single crystals of CdF_2 by growing from a powdered fluoride melt is reported. Data are presented on the transmittance of CdF_2 in the region 0.203 to 13 μ and on the refractive index. (L.T.W.)

4750

INFRARED AND RAMAN SPECTRA OF FLUORINATED ETHANES. VII. $\text{CCl}_3\text{CF}_2\text{Cl}$ AND $\text{CCl}_3\text{CFCI}_2$. J. Rud Nielsen, C. Y. Liang, D. C. Smith, and Morris Alpert. *J. Chem. Phys.* 21, 1070-6(1953) June.

The infrared spectra of liquid $\text{CCl}_3\text{CF}_2\text{Cl}$ and of $\text{CCl}_3\text{CFCI}_2$ as glass and in CS_2 solution, have been obtained in the region from 2 to 38 μ with the aid of LiF, NaCl, KBr, and KRS-5 prisms. The Raman spectra of these compounds in the liquid state, at about 50 and 120°C, respectively, were photographed with a three-prism glass spectrograph of linear dispersion 15 Å/mm at 4358 Å. Relative intensities and depolarization ratios were measured for all but the weakest Raman bands. Complete assignments of fundamental vibration frequencies have been made, the spectra have been interpreted in detail, and thermodynamic functions have been calculated. (auth)

LABORATORIES AND EQUIPMENT

4751

Atomic Energy Research Establishment, Harwell, Berks (England)
A MAGNETIC FILTER—PRELIMINARY DEVELOPMENT. D. F. Kelsall. July 1950. 12p. (AERE-CE/M-54)

Preliminary tests have been carried out to investigate the characteristics of porous filter beds consisting of fine ferromagnetic particles supported, by electromagnetic fields, on relatively coarse metal grilles inside a 2-in.-OD stainless-steel tube. The results of the tests are discussed later. Satisfactory filtration tests were carried out on freshly precipitated BaSO_4 through a bed of fine alumina supported by a ferromagnetic bed. A comparison was made with a similar bed of alumina supported on a medium-grade glass sinter. (auth)

MOLECULAR STRUCTURE

4752

Spectroscopy Lab., Ill. Inst. of Tech.
POTENTIAL CONSTANTS FOR DEUTERIUM AND HALOGEN SUBSTITUTED METHANES [PROGRESS REPORT]; TECHNICAL REPORT ON MOLECULAR SPECTROSCOPY, MOLECULAR STRUCTURE AND THERMODYNAMICS. Submitted July 3, 1953. 12p. (NP-4652; Technical Report 14)

Bond-stretching constants, bond-interaction constants, bond-angle interaction constants, and angle and angle-angle interaction constants for various deuterium- and halogen-substituted methanes are tabulated. (J.S.R.)

RADIATION CHEMISTRY

4753

Brookhaven National Lab.
THE PRODUCTION OF IODINE FROM SOLUTIONS OF POTASSIUM IODIDE IRRADIATED WITH HARD X-RAYS. Everett R. Johnson. [1952] 6p. (BNL-1442)

Solutions of KI, 3.17M to 0.001M, were irradiated with x rays from a 2-Mev electrostatic generator. The I formed was determined by measuring the absorption at 350 m μ . The results indicate that I and H have the same initial rates of formation. The initial rate of formation of I is increased by the addition of H to the solution, and inhibited by O and I. O or H_2O_2 appear only after the I concentration has reached a critical level. (J.S.R.)

4754

Brookhaven National Lab.
THE YIELDS OF FREE H AND OH IN THE IRRADIATION OF WATER. A. O. Allen. [1953] 25p. (BNL-1498)

Experimental investigations of the quantitative radiation chemistry of water solutions are reviewed. It is pointed out that indirect action of radiation on solutes is generally ascribed to formation of chemically reactive free radicals, H and OH, by radiation decomposition of the water. In addition, the molecular decomposition products H_2 and H_2O_2 always appear, in a yield which diminishes as the ion density of the radiation decreases, and the yield of these four products should be deducible from the yields of various reactions brought about by irradiation of water solutions. Contradictions in evidence regarding the existence of an excess of H atoms and H_2O_2 over OH and H_2 are discussed. It is concluded that in spite of the large amount of careful experimental work which has gone into the subject, and in spite of the relative simplicity of the system, there is still no firm experimental grounding for any theory of the radiation chemistry of water. (C.H.)

4755

BREAKDOWN OF METHYL METHACRYLATE POLYMER BY HIGH-ENERGY RADIATION. A. Charlesby and M. Rose. *Nature* 171, 1153(1953) June 27.

Exposure of methyl methacrylate polymers to high-energy radiation caused expansion, forming a white, brittle material, consisting of a mass of bubbles. When these specimens were afterwards heated, internal bubbling occurred, and the material expanded to six to eight times its original volume. Critical radiation and temperature levels are presented. The possible use of irradiated methyl methacrylate polymers as a heat-insulating material is mentioned. (C.H.)

4756

THEORY OF RADIATION CHEMISTRY. II. TRACK EFFECTS IN RADIOLYSIS OF WATER. Aryeh H. Samuel and John L. Magee. *J. Chem. Phys.* 21, 1080-7(1953) June.

A model is presented which describes the geometrical effects in the radiolysis of water as a result of the diffusion of free radicals. The motion of secondary electrons immediately following the passage of the ionizing particle is discussed in an appendix, and it is concluded that radicals are most likely formed in pairs at the approximate sites of the original ionizations. Models for the diffusion of these radicals are shown to result in a definite fraction of radicals which undergo initial recombination for γ and fast β rays, for which the spurs are considered as diffusing independently. For α rays a connected-track model is used. For the intermediate case of tritium β rays, a two-stage model is constructed. In each case the comparative yields of the

"forward" and "radical" reactions (G_F and G_R) are calculated. Subsequent chemical effects in pure water and solutions are also considered briefly. (auth)

RADIATION EFFECTS

4757

Oak Ridge National Lab.

RADIATION STABILITY STUDIES: PART 1. AQUEOUS ETHYLENEDIAMINE TETRAACETATE AND ACETATE SOLUTIONS. PART 2. BECKMAN GLASS pH ELECTRODES. R. E. Blanco, A. H. Kibbey, and J. H. Pannell. Issued Sept. 22, 1952. Decl. with deletions June 1, 1953. 18p. (AECD-3529; ORNL-1379)

An investigation of the radiation stabilities of aqueous solutions of Na (ethylenediamine)tetraacetate and sodium acetate was made using a 3000-c Co⁶⁰ source. It was found that the initial decomposition rate of the tetraacetate was 0.62 millimole/whr of absorbed energy. The decomposition rate of the simpler acetate ion was not determined quantitatively, but the small changes in the physical properties of the solution indicated a negligible or very low decomposition rate. A study of the behavior of standard-size Beckman-type glass pH electrodes in a solution containing 0.36 c of Ce¹⁴⁴-Pr¹⁴⁴ activity per milliliter showed the useful electrode life to be of the order of 2 to 8 days. (auth)

4758

"AFTER-EFFECT" IN AQUEOUS SOLUTIONS OF DESOXYRIBONUCLEIC ACID IRRADIATED WITH X-RAYS. Malcolm Daniels, George Scholes, and Joseph Weiss. *Nature* 171, 1153-4(1953) June 27.

Desoxyribonucleic acid was irradiated both in the presence of atmospheric O and under O-free conditions, and the effects of O concentration on viscosity studied. Data presented indicate that, although molecular O is not a decisive factor, its presence can enhance the attack on nucleic acid. A slow decrease of viscosity which continued for some time after the actual irradiation in an O-free atmosphere was about one-third of that observed when irradiation took place in atmospheric O. (C.H.)

RARE EARTHS AND RARE-EARTH COMPOUNDS

4759

Ames Lab.

A PRACTICAL SEPARATION OF YTTRIUM GROUP RARE EARTHS FROM GADOLINITE BY ION-EXCHANGE. F. H. Spedding and J. E. Powell. May 27, 1953. 32p. (ISC-349)

The basic concepts of the separation of rare earths by ion exchange have been discussed briefly, and a pilot plant utilizing these ideas has been described. In order to illustrate the efficiency of this pilot-plant design, data for a typical run have been presented. Starting with a crude rare-earth concentrate from the mineral gadolinite, containing approximately 0.6% Lu, 4% Yb, 0.6% Tm, 4% Er, 1% Ho, 6% Dy, 60% Y, and 23% other rare earths, 82% of the available Er and 50% of the Yb were obtained greater than 99.9% pure in a single operation. Some Dy and Y were obtained greater than 99.9% pure, and excellent yields of nearly pure Tm and Ho were also obtained. The Lu was obtained as enriched binary mixtures with Yb and was completely separated from Tm and the other rare earths. These binary mixtures can be resolved readily by extraction with Na amalgam. (auth)

SEPARATION PROCEDURES

4760

Ames Lab.

CAUSTIC TREATMENT OF ZIRCON IN THE PREPARATION OF PURE ZIRCONIUM COMPOUNDS. Donald R. Spink and H. A. Wilhelm. Mar. 1952. Decl. with deletions June 23, 1953. 55p. (AECD-3534; ISC-217)

This investigation was conducted in order to develop a process whereby the most abundant Zr ore, namely zircon, could economically be put into solution and purified adequately for use in Hf separation processes employing liquid-liquid extraction. Secondary aims concerned the preparation of pure $ZrOCl_2$, $ZrO(NO_3)_2$, $ZrOSO_4$, and ZrO_2 from the zircon ore. Caustic soda was found to be a suitable agent for the decomposition of zircon sand ($ZrSiO_4$). Using an optimum ratio of 1.1 parts by weight of caustic soda to one part of zircon sand, $NaZrO_3$ and Na_4SiO_4 with small amounts of Na silicocarbonate were formed after heating for one to two hr in a furnace set at an optimum temperature of about 650°C. The resulting product was a light-colored, granular material from which the water-soluble Na_4SiO_4 was easily removed in a hot-water leaching operation. The water-insoluble zirconates were put into solution with hydrochloric acid. $ZrOCl_2$ was then crystallized from this solution to remove Fe, Ti, some silica, and other soluble impurities. The crystalline $ZrOCl_2$ was then separated from its mother liquor in such a manner as to give a very dry crystal. These crystals were then put into a water solution which was clarified in order to remove silica. The resulting $ZrOCl_2$ solution could be used directly to make feed material for the liquid-liquid extraction systems, or processed further to give high-purity Zr (or zirconyl) compounds such as the oxide, chloride, nitrate, and sulfate. The total cost per pound of Zr processed by this method was estimated to be about 50 cents. This figure compares favorably with the present cost of about 90 cents per pound of Zr content commercially available as $ZrCl_4$. The product of the caustic treatment was also of a higher purity than that from the tetrachloride. (auth)

4761

Atomic Energy Research Establishment, Harwell, Berks (England)

LIQUID-LIQUID EXTRACTION. PART 4. A FURTHER STUDY OF HOLD-UP IN PACKED COLUMNS. R. L. Gayler, N. W. Roberts, and H. R. C. Pratt. Mar. 6, 1953. 35p. (AERE-CE/R-903)

Further determinations of hold-up have been carried out for a number of liquid-liquid systems using a range of packings up to 1½-in. size in columns of 6- and 12-in. ID. An improved expression, based on that given in Part II, has been obtained relating the hold-up to the phase flow rates as follows:

$$V_d + \frac{x}{1-x} V_c = \epsilon \bar{v}_0 x(1-x)$$

In this expression, \bar{v}_0 , which is termed the "characteristic velocity" is the limiting mean droplet velocity at zero flow rates. A nomogram is given for the solution of this equation, and a procedure is described using this to determine the flowrates for which the hold-up is a maximum. This condition appears to correspond approximately to the upper transition point of Ballard and Piret. Three alternative methods for the correlation of the characteristic velocity have been examined. Of these, the following expression, based on a droplet-collision theory, was found to represent the data with a mean error (disregarding sign) of $\pm 7.2\%$ and is recommended for general use:

$$y = 1 - \frac{y}{z} \left(1 - e^{-z/y} \right)$$

where

$$y = \frac{\bar{v}_0}{v_c} \left(1 - e^{-7.2z} \right) \text{ and } z = \frac{\Delta p g \bar{S}}{\rho_d V_t}$$

In this expression the mean free path between collisions, \bar{S} , was found to be given by:

$$\bar{S} = 0.38 d_p - 0.92 \left(\frac{\gamma}{\Delta p g} \right)^{1/2}$$

By equating \bar{s} to zero and solving for d_p an upper limit is obtained to the critical packing size. (auth)

4762

Atomic Energy Research Establishment, Harwell, Berks (England)
LIQUID-LIQUID EXTRACTION. PART 5. FURTHER STUDIES OF DROPLET BEHAVIOUR IN PACKED COLUMNS. R. L. Gayler and H. R. C. Pratt. Mar. 1953. 16p. (AERE-CE/R-904)

Mean droplet sizes have been determined for the system ethyl acetate-water with $\frac{1}{2}$ -in. Raschig rings. Further droplet-size determinations have also been carried out for the system methyl isobutyl ketone-water owing to doubts about earlier results. The effects of incomplete mutual saturation of the phases and of the presence of an unequilibrium solute have also been investigated. It was found that the mean droplet size is increased in the former case, and also in the latter case when the solute is present in the dispersed (solvent) phase. When it is present in the continuous phase, or is brought to equilibrium between the phases, the droplet size is normal. The effect of these results on the design of packed extraction columns is discussed briefly. (auth)

4763

Ames Lab.
A GENERALIZATION OF THE POLANYI THEORY OF ADSORPTION FROM SOLUTION. Robert S. Hansen and Walter V. Fackler, Jr. Feb. 15, 1953. 14p. (ISC-330)

The Polanyi theory of the adsorption from solution of solutes of limited solubility is corrected and generalized to non-ideal solutions of complete miscibility. Necessary assumptions and their limitations are discussed. Isotherms for the adsorption of water, 1-propanol, and 1-butanol from the vapor phase at 25°C have been measured and the results used to calculate isotherms for the adsorption of 1-propanol and 1-butanol from aqueous solutions. The calculated isotherm is in qualitative and rough quantitative agreement, in the case of the 1-propanol-water system, with that observed experimentally. Deviations in the 1-butanol-water system are more pronounced. Reasons for these deviations and appropriate corrections are suggested. (auth)

4764

Livermore Research Lab., Calif. Research and Development Co.
CASCADE ANALYSIS OF TRANSIENT BEHAVIOR IN MULTIPLE STAGewise CONTACTING UNITS. P. L. Auer and C. S. Gardner. Mar. 12, 1953. 19p. (MTA-7)

Countercurrent batchwise extraction between two immiscible phases is described by means of a cascade diagram. A set of difference equations is developed on the basis of the cascade process, and its solution is related to the complete characterization of transient behavior in the contacting system. This general scheme of analysis is applied to a simple end-fed column and a center-fed column with constant extraction factors. (auth)

4765

Oak Ridge National Lab.
STUDIES ON THE ELECTROLYTIC SEPARATION AND DETERMINATION OF TIN, ANTIMONY, AND BISMUTH WITH CONTROLLED CATHODE POTENTIAL. S. A. Reynolds. Issued July 6, 1953. 58p. (ORNL-1557)

A study was made of the separation and determination of Bi, Sb, and Sn by electrochemical means, using controlled cathode potential. The effects of electrolyte composition, cathode potential, and temperature were investigated with respect to separations of the three metals and degree of recovery of each. Radioactive tracers were employed to a limited extent and yielded useful information. Best results were obtained by use of an electrolyte containing sulfate

and citrate. A procedure was devised which would serve for approximate analysis for Bi, Sb, and Sn in the form of mixtures and alloys. Further investigation along similar lines might lead to improved analytical results. (auth)

4766

PAPER CHROMATOGRAPHIC SEPARATION OF VANADIUM AND MOLYBDENUM IN MICROGRAM QUANTITIES AND A METHOD OF DIRECT TITRATION. A. Lacourt, Gh. Sommereyns, J. Hoffman, S. Frank-Frederic, and G. Wantier. *Anal. Chim. Acta* 8, 444-59(1953) May. (In French)

Chromatographic behavior on paper of Mo and V when mixed in the same solution has been studied. Very good qualitative separations have been found for both elements. Quantitative control of these separations has been checked by direct titration of the chromatographed spot on the paper. This technique speeds the whole procedure very much without harming in any way the accuracy of the determinations. (auth)

4767

SEPARATION OF BERYLLIUM FROM ALUMINIUM AND IRON BY PAPER STRIP CHROMATOGRAPHY. C. Ladshman Rao and Jagdish Shankar. *Anal. Chim. Acta* 8, 491-2(1953) May.

Successful separation of Fe, Al, and Be as chlorides is described. Methyl ethyl ketone is used as the carrier. Phosphate does not interfere with the separation, but Ca and Mg move with the Be. (K.S.)

4768

FRACTIONATION OF ISOTOPES BY DISTILLATION OF SOME ORGANIC SUBSTANCES. P. Baertschi, W. Kuhn, and H. Kuhn. *Nature* 171, 1018-20(1953) June 6.

The distillation of chloroform, carbon tetrachloride, methyl alcohol, and benzene were found to lead to an enrichment of C^{13} in the distillate, whereas the other heavy isotopes such as Cl^{37} and O^{18} were enriched in the still pot. The distillation apparatus is described and results of each distillation reported. It is suggested that results indicate the possible existence of a general rule stating that, in isotopic molecules having a central atom, the molecular variety containing the heavier isotope of the central atom will exhibit a somewhat higher vapor pressure than the variety containing the lighter isotope as central atom. (C.H.)

4769

THE QUANTITATIVE SEPARATION OF ESTROGENS BY PAPER PARTITION CHROMATOGRAPHY. Leonard R. Axelrod. *J. Biol. Chem.* 201, 59-69(1953) Mar.

Chromatographic systems have been developed for the resolution of the natural estrogens plus diethylstilbestrol and 17-ethinylestradiol utilizing the solvent systems, *o*-dichlorobenzene-formamide, methylene chloride-formamide and cyclohexene-formamide. Spot tests for these steroids on paper chromatograms in as little as 5- γ quantities are also described. The absorption spectra of these steroids in concentrated H_2SO_4 are also depicted in graphic form as an aid in the identification of these steroids. Preliminary experiments on the extraction of estrogens from dog bile and female urines are included. (auth)

SORPTION PHENOMENA

4770

Argonne National Lab.
ABSORPTION OF SOME HALOGEN GASES FROM AIR BY A LIMESTONE BED AND A SPRAY TOWER. R. C. Liimatainen and M. Levenson. Apr. 1, 1953. 30p. (ANL-5015)

The effectiveness of an oolitic limestone bed was compared with that of a spray tower for removal of highly

toxic halogens and their compounds from an air stream. The limestone bed with $\frac{1}{8}$ - to $\frac{1}{4}$ -in. particles can be used at high efficiencies to remove HF, but it is not satisfactory for other halogens. The spray tower will effectively remove interhalogens, H halides, and elemental halogens from an air stream. (J.S.R.)

SPECTROSCOPY

4771

THE INFRARED SPECTRUM OF FLUOROFORM FROM 2.2 TO 20 μ . H. D. Rix. *J. Chem. Phys.* **21**, 1077-9(1953) June.

The absorption spectrum of fluoroform has been investigated with a Perkin-Elmer double-pass spectrometer from 2.2 to 20 μ . The resolution is sufficient to make possible an unequivocal assignment of all six fundamentals on the basis of the observed band envelopes. An anomaly is found in the symmetrical C-F stretching vibration; on the evidence now available this vibration should be assigned to the parallel band at 1209.3 cm^{-1} in the infrared (vapor) and to the polarized Raman line (liquid) at 1117 cm^{-1} . Overtone and combination bands measured include the A_1 and E components of the second harmonic of each of the three degenerate fundamentals. The separation of the maxima of the P and R branches of the parallel bands is discussed in relation to the theory of Gerhard and Dennison. (auth)

SYNTHESES

4772

Brookhaven National Lab.
ALKALOID BIOGENESIS. 4. THE NON-AVAILABILITY OF NICOTINIC ACID-CARBOXYL- ^{14}C AND ITS ETHYL ESTER FOR NICOTINE BIOSYNTHESIS. R. F. Dawson, David R. Christman, and R. Christian Anderson. [1952] 7p. (BNL-1477)

Carboxyl- C^{14} -labeled nicotinic acid and ethyl nicotinate failed to yield isotopically labeled nicotine when supplied to the principal nicotine-synthesizing tissues of the tobacco plant. Consequently, the Winterstein-Trier hypothesis of alkaloid biosynthesis in the genus *Nicotiana* is rejected. (auth)

4773

DISTRIBUTION OF RADIOACTIVITY IN LABELED POLYMERS. Louis Gold. *Nucleonics* **11**, No. 7, 48-50(1953) July.

Methods of preparing labeled polymers from labeled monomers, by addition of active groups to unreacted linkages, and by the mixing of labeled and unlabeled polymers are described. Dependence of distribution of radioactivity in the polymer on the labeling method used is discussed. (C.H.)

URANIUM AND URANIUM COMPOUNDS

4774

CONDITIONS OF FORMATION AND CHARACTERIZATION OF THE PHOSPHATES OF HEXAVALENT URANIUM. Marthe Domine-Berges. *Compt. rend.* **236**, 2242-4(1953) June 8. (In French)

The conditions of the precipitation of nitrate solutions of hexavalent U by solutions of phosphoric acid were studied. The monoacid and neutral phosphates can be identified by the x-ray spectra. The reaction of phosphoric acid upon UO_3 resulted in a salt with the diacid phosphate composition. The x-ray spectra are given. The stability of the salts under thermal treatment is discussed. (J.S.R.)

ENGINEERING

4775

Powder Weld Process Co.
[RESEARCH INTO MATERIALS AND METHODS TO

PRODUCE POLYETHYLENE LININGS ON CONCRETE AND OTHER SURFACES]; PROGRESS REPORT. R. A. Wiese. June 27, 1953. 20p. (NYO-6228)

The work and results accomplished in the research on materials and methods to produce flame-sprayed, hot-melt polyethylene linings on concrete and other surfaces are outlined. Preparation of surfaces, application of materials, and control of shrinkage are discussed. (J.E.D.)

4776

California Univ., Los Angeles
MASONRY STRUCTURES UNDER BLAST. C. Martin Duke. Dec. 1951. 31p. (UCLA-51.15)

The masonry building is considered as a structure subjected to impulsive horizontal blast loading, with particular reference to transversely loaded walls. Present status of knowledge of facts, theories, and analytical methods is outlined, and contributions during 1951 by the Dept. of Engineering, Univ. of Calif., Los Angeles, are discussed in relation to this broad picture. (auth)

HEAT TRANSFER AND FLUID FLOW

4777

Lewis Flight Propulsion Lab., NACA
MEASUREMENTS OF HEAT-TRANSFER AND FRICTION COEFFICIENTS FOR AIR FLOWING IN A TUBE OF LENGTH-DIAMETER RATIO OF 15 AT HIGH SURFACE TEMPERATURES. Walter F. Weiland and Warren H. Lowdermilk. July 9, 1953. 19p. (NACA-RM-E53E04)

Measurements of average heat-transfer and friction coefficients were obtained with air flowing through a smooth, electrically heated tube with a bellmouth entrance, and with a length-to-diameter ratio of 15 for a range of average surface temperature from 875 to 1735°R, Reynolds number from 2200 to 300,000, exit Mach numbers up to unity, and heat fluxes up to 230,000 Btu/hr/ft² of heat-transfer area. The results indicate that in the turbulent range of Reynolds numbers based on tube diameter, good correlations of the average heat-transfer and friction coefficients are obtained when the physical properties and density of the air are evaluated at a reference film temperature midway between the surface and fluid bulk temperature. The average heat-transfer coefficients correlated with those obtained previously from the same test equipment with longer tubes (length-to-diameter ratios of 30, 60, and 120) at high surface temperatures and heat fluxes on the basis that the average heat-transfer coefficient varies as the -0.1 power of the length-to-diameter ratio. The average friction coefficients were the same as the values obtained with longer tubes for Reynolds numbers above approximately 30,000. In the transition from the laminar to the turbulent range of Reynolds numbers, the reference film temperature did not give good correlation, and the average heat-transfer and friction coefficients increased with increasing ratio of surface-to-fluid bulk temperature when the fluid properties and density were evaluated at the fluid-film temperature. (auth)

4778

Lewis Flight Propulsion Lab., NACA
EXPERIMENTS ON MIXED-FREE-AND-FORCED-CONVECTIVE HEAT TRANSFER CONNECTED WITH TURBULENT FLOW THROUGH A SHORT TUBE. E. R. G. Eckert, Anthony J. Diaguila, and Arthur N. Curren. July 1953. 59p. (NACA-TN-2974)

Convective heat-transfer experiments were conducted for turbulent, mixed-free- and -forced-convection flow through a vertical heated tube with a length-to-diameter ratio of 5. Studies were made with forced air flowing parallel or opposite to the free convection flow. The Grashof numbers ranged from 10^8 to 10^{13} and the Reynolds numbers from 36×10^3 to 377×10^3 . These experiments together with

results obtained by other investigators revealed that the total flow regime characterized by the Reynolds and Grashof numbers can be divided into a forced-flow regime, a free-flow regime, and a mixed-free- and -forced-convection regime. The limits for the different regimes were established. (NACA)

4779

Aeronautical Research Council, Rockets Sub-Committee (Great Britain)
SOME EXPERIMENTS ON THE HEAT TRANSFER FROM A GAS FLOWING THROUGH A CONVERGENT-DIVERGENT NOZZLE. O. A. Saunders and P. H. Calder. Jan. 5, 1952. 13p. (NP-4639)

Heat transfer at high subsonic and supersonic speeds is more complicated than at normal velocities because the cross-sectional temperature distribution is not usually fully developed. The central core of gas is often unaffected by the heat added, in contrast to one dimensional flow calculations which assume the heat to be spread over the whole cross section. Experiments are described using a water-cooled convergent-divergent nozzle of smooth continuous profile through which hot gases at 865°C were passed and the heat transfer measured at different positions along the divergent portion, at Mach numbers up to 1.75. The results are very consistent when plotted in terms of the length Reynolds number measured from the throat. Velocity traverses at the exit also confirm that the boundary layer may be assumed to be turbulent and to commence at the throat. The heat transfer results also agree very well with the formulas for turbulent flow over a flat plate at low speeds, suggesting that such low speed formulas may be used for supersonic flow in nozzles. Some tests with a straight pipe at high subsonic speeds give results somewhat higher than the flat plate formula, due probably to pipe-radius effects. (auth)

4780

Columbia Univ.
BOILING AND CONDENSING OF LIQUID METALS. C. F. Bonilla and B. Misra. April 25, 1953. 9p. (NYO-3152)

Additional runs have been made on the condensing of Hg vapor at atmospheric pressure and 330,000 to 650,000 Btu/hr-ft² on carbon-steel, stainless steel, and Ni, under wetting, semi-wetting, and non-wetting conditions. The highest heat-transfer coefficient observed under any conditions was 2345 Btu/hr-ft²-°F, for completely wetted Ni, which is less than 20% of the theoretical Nusselt value. Tests run in the presence of H and of N showed that traces of inert gas were not causing the decrease in coefficient. It is believed that the decrease is due to thermal contact resistance between the Hg and the condensing surface. This hypothesis is supported by earlier work on contact resistance. (auth)

4781

Lewis Flight Propulsion Lab., NACA
INTERNAL-LIQUID-FILM-COOLING EXPERIMENTS WITH AIR-STREAM TEMPERATURES TO 2000°F IN 2- AND 4-INCH-DIAMETER HORIZONTAL TUBES. George R. Kinney, Andrew E. Abramson, and John L. Sloop. 1952. 21p. (NACA-1087)

An experimental investigation of internal-liquid-film cooling was conducted in 2- and 4-in.-diam. straight metal tubes with air flows at 600 to 2000°F and Reynolds numbers from 2.2 to 14 × 10⁵. The coolant was water at flows of 0.8 to 12% of air flow. Visual observations of liquid-film flows at 80 and 800°F and diameter Reynolds numbers from 4.1 to 29 × 10⁵. Flows of water, water-detergent solutions, and aqueous ethylene glycol solutions were investigated. Liquid-coolant films were established and maintained around and along the tube wall in concurrent flow with the hot air. The

tube wall was kept below the boiling temperature of the coolant over the surfaces covered by liquid coolant. Coolant films were relatively smooth unless the coolant flow was sufficiently high so that the liquid film was thick enough to enter the region where turbulent forces predominate over viscous forces; wavelike disturbances then developed on the liquid film. These disturbances resulted in increased loss of coolant from the film and reduced effectiveness of the coolant. (auth)

4782

Ames Aeronautical Lab.
HEAT TRANSFER TO BODIES IN A HIGH-SPEED RAREFIED-GAS STREAM. Jackson R. Stalder, Glen Goodwin, and Marcus O. Creager. 1952. 10p. (NACA-1093)

The equilibrium temperature and heat-transfer coefficients for transverse cylinders in a high-speed stream of rarefied gas were measured over a range of Knudsen numbers from 0.025 to 11.8 for Mach numbers from 2.0 to 3.3. Fully developed free-molecule flow was found to occur first at Knudsen numbers of approximately 2.0. The Nusselt number was found to be a function of the Reynolds number only, and the temperature-recovery factor to depend primarily on the Knudsen number. (NACA)

4783

LIQUID-METAL HEAT-TRANSFER SYSTEM FOR NUCLEAR POWER PLANTS. A REPORT ON THE DEVELOPMENT OF SUITABLE HEAT EXCHANGERS AND STEAM GENERATORS. Thomas Trocki and D. B. Nelson. *Mech. Eng.* 75, 472-6(1953) June.

The design and operation of the liquid-metal heat-transfer system at Knolls Atomic Power Lab. are discussed. The system employs a primary Na circuit in series with a secondary Na-K alloy circuit which is used as the heating medium for the steam generator. Methods of securing leak tightness and of purifying the liquid metals are described. Three years of test operation reveal the system to be feasible for steam generation. Measured performance agrees well with the predicted performance, and satisfactory solutions to the problems of corrosion, maintenance, and periodic repurification of the Na have been obtained. (L.M.T.)

MATERIALS TESTING

4784

Ballistic Research Labs., Aberdeen Proving Ground
SHOCK TUBE TESTS OF GLAZING MATERIALS. William J. Taylor and Robert O. Clark. Nov. 1952. 37p. (BRL-Memo-626)

In the event of an atomic bomb attack, the hazard of flying glass may extend over an area of approximately 200 square miles. This investigation provides evidence that the area of common window glazing hazard could be reduced to coincide with the area of moderate structural damage or to approximately 7 square miles, by proper selection of glazing material. (auth)

4785

Lewis Flight Propulsion Lab., NACA
BEHAVIOR OF MATERIALS UNDER CONDITIONS OF THERMAL STRESS. S. S. Manson. July 1953. 105p. (NACA-TN-2933)

A review is presented of available information on the behavior of brittle and ductile materials under conditions of thermal stress and thermal shock. For brittle materials, simple formulas relating physical properties to thermal-shock resistance are derived and used to determine the relative significance of two indices currently in use for rating materials. The importance of simulating operating conditions in thermal-shock testing is deduced from the formula and is experimentally illustrated by showing that

BeO could be both inferior or superior to Al_2O_3 in thermal shock depending on the testing conditions. For ductile materials, thermal-shock resistance depends upon the complex interrelation among several metallurgical variables which seriously affect strength and ductility. These variables are briefly discussed and illustrated from literature sources. The importance of simulating operating conditions in tests for rating ductile materials is especially to be emphasized because of the importance of testing conditions in metallurgy. A number of practical methods that have been used to minimize the deleterious effects of thermal stress and thermal shock are outlined. (auth)

4786

Illinois Univ.

AN APPRAISAL OF THE PROT METHOD OF FATIGUE TESTING. PART 2. H. T. Corten, Todor Dimoff, T. J. Dolan, and Masaki Sugi. June 1953. 54p. (NP-4649; Technical Report 35)

This report presents a further study of the method of fatigue testing suggested by Marcel Prot and should be regarded as a continuation of the material in Part 1(NP-4311) of this investigation. The Prot progressively increasing load method of fatigue testing has been investigated by comparing the experimental results for three ferrous metals with conventional fatigue data. Both notched and unnotched specimens have been studied. Two procedures have been employed in analyzing the data. The first method makes use of the results of conventional fatigue data (obtained with constant stress amplitude) to evaluate an experimental constant required to obtain the optimum value of the endurance limit from the Prot data. The second procedure employs the general method of least squares and statistical analysis to obtain the optimum value of the endurance limit and an estimate of the statistical variation from only the data obtained with progressively increasing loads. The Prot method of fatigue testing appears most promising for rapid estimation of the endurance limit of ferrous metals. (auth)

4787

Radiation Lab., Univ. of Calif., Berkeley

MEASUREMENTS OF THE EFFECTS OF MOISTURE IN NUCLEAR TRACK EMULSION. Albert J. Oliver. Apr. 6, 1953. 20p. (UCRL-2176)

Thickness and density measurements were made on Ilford nuclear-track emulsions before and after processing. Measurements were made as equilibrium was approached under various conditions of ambient relative humidity. Thickness measurements were made with a modified dial micrometer. Volume measurements were made by weighing plates immersed in carbon tetrachloride. A special study of plates stored in a vacuum was carried out. The washing time was found to have an important effect on the shrinkage factor. The data obtained are presented in a number of tables and graphs. The theory of water diffusion in emulsion has been appended by W. H. Barkas, and the emulsion constants evaluated from the experimental data. Attention is directed to the very long characteristic diffusion times implied for thick emulsions. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

4788

Battelle Memorial Inst.

PREPARATION AND EXAMINATION OF BERYLLIUM

CARBIDE. M. W. Mallett, E. A. Durbin, M. C. Udy, D. A. Vaughan, and E. J. Center. May 25, 1953. Decl. June 26, 1953. 24p. (AECD-3533; BMI-MWM-5)

The properties of Be carbide were studied to determine its suitability as a high-temperature refractory. Various methods of preparing it were tried, and a number of the physical and chemical properties of the resulting products were determined. Lots containing 85 wt.% of useful product were prepared by the Be metal-C reaction. Because the material was to be fabricated into refractory bodies, particular attention was paid to the chemical analysis for unreacted BeO, Be metal, and free C, x-ray-diffraction identification of the various phases present and microscopical examination for mineral composition, crystal size, and crystal habit. As a refractory, Be carbide has several disadvantages. It tends to hydrolyze in atmospheric moisture and must be protected against both O and N when heated. (auth)

4789

Argonne National Lab.

PREPARATION OF URANIA REFRACTORIES. George B. Eyerly, W. A. Lambertson, R. G. Kraft, and R. E. Corwin. Mar. 24, 1953. 7p. (ANL-5038)

Defects in pure UO_2 crucibles fired in a graphite induction furnace indicated a need for the addition of mineralizers to improve firing strength. The jolt-packing and dry-press processes were used with mixtures of UO_2 and 2 to 10% of oxides and salts; all attempts were unsatisfactory. Similar tests were made in a molybdenum resistance furnace with a H atmosphere and were all successful, including those with pure UO_2 and $\text{UO}_2\text{-UF}_4$. Use of this furnace also eliminated carbide deposition. It was concluded that mineralizers did not benefit the firing process. Stopper rods were fabricated by the extrusion and slip-casting methods. Slip casting proved more reliable, but the production of long rods is not feasible. Several methods of preparing slips are described. It was noted that alumina-dust contaminations were eliminated by refractory cleaning and by maintaining temperatures below 1750°C . The microstructure of UO_2 after 4 hours firing at 2000°C showed poorly defined grains about $40\ \mu$ in diameter. (For preceding period see ANL-4855.) (K.S.)

4790

Pennsylvania State Coll. School of Mineral Industries
REFRACTORIES FOR USE IN HIGH TEMPERATURE
AREAS OF AIRCRAFT: BIMONTHLY PROGRESS REPORT.
W. H. Rice, E. A. Bush, N. R. Thielke, and W. R. Buessem.
Apr. 16, 1953. 47p. (NP-4642; Memo Report 18)

A literature review of phase relationships in the system TaC-NbC-TiC reported data in the contributory fields of metal-C relationships, metal oxide-C reactions and subordinate binary carbide systems. This was preliminary to the present research program, on the behavior of ternary carbide compositions, which incorporates reactions in the three categories indicated. A review of methods for determining degree of oxidation and of typical laws obeyed during oxidation behavior is included as background for eventual evaluation of ternary carbide compositions. Thermal-shock-testing procedures and theory reported in the general technical literature were summarized. A detailed description is given of the modified ring test used in this laboratory for determination of thermal conductivity and thermal stress resistivity. In addition, the thermal-shock-testing procedure of several cooperating contractors were analyzed on the basis of shapes tested and criteria of failure. (auth)

4791

Massachusetts Inst. of Tech.

THE MEASUREMENT OF THERMAL CONDUCTIVITY OF REFRACTORY MATERIALS; PROGRESS REPORT. F. N. Norton, W. D. Kingery, et al. July 1, 1953. 10p. (NYO-3646)

Thermal conductivity for CaO, UO_2 , fused quartz, soda-lime-silica glass, and TiN is reported. Specimens for further investigation of the effects of emissivity on the thermal conductivity of porous samples and samples with isotropic pores have been completed. Investigation of the effects of crystal mixtures, solid solutions, and radiant transmission on heat transfer is in progress. (For preceding report in series see NYO-3644.) (auth)

4792

CERAMIC MATERIALS FOR REACTORS. Nucleonics **11**, No. 7, 20-1(1953) July.

A recent meeting concerned with research and development aimed at producing high-temperature materials with desirable nuclear properties is summarized, including brief notes of papers on refractories for nuclear reactors, properties of HfO_2 , resistance to liquid metals, and cermets. (L.T.W.)

CORROSION

4793

Oregon Univ.

ELECTROCHEMICAL AND POLAROGRAPHIC STUDIES ON THE CORROSION OF ZIRCONIUM IN PRESENCE OF VARIOUS AQUEOUS MEDIA; PROGRESS REPORT. George B. Adams, Jr., Mario Maraghini, and Pierre Van Rysselberghe. June 12, 1953. 9p. (AECU-2592)

The anodic polarization of Zr and of some of its alloys was studied over periods of time ranging from 6 sec to several hours after dipping of the coupons into the solutions, and with external currents ranging from 0.5 to $2000 \mu\text{A}/\text{cm}^2$. The evolution of the potential was also followed in the absence of external current. Solutions of HCl, Na_2CO_3 , KCl, and other salts were used at a temperature of 25°C . Two types of potential-time curves were observed according to whether the solutions did or did not contain Cl^- ion. A preliminary investigation of the polarography of the Zr oxalate complex has been carried out. (For preceding report in series see AECU-2385.) (auth)

GEOLOGY AND MINERALOGY

4794

Division of Raw Materials, AEC

URANIUM INVESTIGATIONS NEAR ALADDIN, CROOK COUNTY, WYOMING. Joseph R. Gray and Anthony C. Tennissen. Issued May 1953. 13p. (RME-4016)

Investigations of radiometrically anomalous areas in the Aladdin area, northern Black Hills, Crook County, Wyoming, indicate a need for further exploration. Many small areas and several large areas of anomalous radioactivity were found in Sections 7, 17, and 18 in T. 54 N., R. 60 W. The size and grade of some of the deposits indicate that they are potential producers of both commercial-grade (greater than 0.10% U_3O_8) and low-grade U-bearing material (0.02 to 0.10% U_3O_8). An apparent NW-SE trend of anomalous areas was noted, a possible structural control exists, and four or more favorable stratigraphic zones of radioactivity were noted. (auth)

4795

Geological Survey

THE OCCURRENCE OF MILLISITE AND PSEUDOWAVELLITE IN THE LEACHED ZONE AT HOMELAND, FLORIDA. J. P. Owens, R. Berman, and Z. S. Altschuler. Mar. 1953. 18p. (TEI-316)

Millisite and pseudowavellite are locally abundant in the leached zone of the highly phosphatic Bone Valley formation in west-central Florida. A sample of a phosphate-cemented quartz sand from Homeland, Fla., was found to contain millisite $[(\text{Na},\text{K})\text{CaAl}_6(\text{PO}_4)_4(\text{OH})_9 \cdot 3\text{H}_2\text{O}]$ and pseudowavellite $[\text{CaAl}_3(\text{PO}_4)_2(\text{OH})_5 \cdot \text{H}_2\text{O}]$ as the principal cementing

agents. These minerals are similar in their physical properties and occur as microcrystalline intergrowths thus preventing separation in quantity by sizing, specific gravity, or magnetic methods. Optical determinations on hand-picked material showed that the aggregate index of refraction of millisite ($n = 1.63$) is higher than that reported for the type millisite from Fairfield, Utah, whereas the aggregate index of refraction of pseudowavellite ($n = 1.59-1.61$) is in the lower range of known pseudowavellite. X-ray studies showed that millisite and pseudowavellite have similar x-ray patterns in some respects. Significant differences exist at certain positions, especially at 4.72 and 2.80 Å where millisite has strong lines. Other minerals known to be present in the rock are quartz, goethite, wavelite, and accessory heavy minerals. (auth)

4796

Geological Survey

SEARCH FOR AND GEOLOGY OF RADIOACTIVE DEPOSITS: SEMIANNUAL PROGRESS REPORT, DECEMBER 1, 1952 TO MAY 31, 1953. June 1953. 302p. (TEI-330)

A general survey of the program of geologic studies in the U. S. is reported. The work consisted of a search for and geology of U in sandstone-type deposits, veins, igneous and carbonaceous rocks, and in phosphate. The search for Th and monazite deposits is also reported. (J.E.D.)

4797

NATURAL VARIATIONS IN THE ISOTOPIC CONSTITUTION OF SILICON. John H. Reynolds and J. Verhoogen. Geochim. et Cosmochim. Acta **3**, 224-34(1953) July 7. (In English)

The isotopic constitution of silicon in minerals and rocks has been examined. In general, the Si^{30} content decreases as one goes from a high-temperature mineral (olivine) to low-temperature pegmatite quartz to vein quartz to geyserite, the greatest isotope separation occurring in the last two steps, which involve deposition from an aqueous phase rather than crystallization from a silicate melt. Organic silica deposited from sea-water (chert, marine diatomite) shows an increase in Si^{30} over olivine, whereas a fresh-water diatomite has an isotopic composition consistent with that of silicon from hot springs (geyserite). The isotopic composition of silicon in a stony meteorite is surprising, as it shows a lower $\text{Si}^{30}/\text{Si}^{28}$ ratio than olivine or even oligoclase from a pegmatite. In general the distribution of the silicon isotopes is similar to that of oxygen isotopes reported by Silverman; some exceptions are noted. The variation in isotopic constitution of silicon is small (the maximum difference encountered in the ratio $\text{Si}^{30}/\text{Si}^{28}$ being 3 per mil) indicating presumably a relatively simple geochemical history involving few opportunities for exchange with gas phases or aqueous solutions. (auth)

4798

SULPHUR ISOTOPE FRACTIONATION IN NATURE AND GEOLOGICAL AND BIOLOGICAL TIME SCALES. H. G. Thode, J. Macnamara, and W. H. Fleming. Geochim. et Cosmochim. Acta **3**, 235-43(1953) July 7. (In English)

The sulfur isotope content of marine sulfide and sulfate deposits, as found in limestone and shales covering a wide range of geological ages, has been investigated. The results indicate a striking correlation between geological age and isotopic content, particularly for the sulfides. It would appear that isotopic fractionation began about 700 to 800 million years ago and that since then the sulfides have been depleted and the sulfates enriched in the heavy isotopes of sulfur. The maximum spread in the $\text{S}^{32}/\text{S}^{34}$ ratio at the present time is about 7% or about the fractionation expected, if the most favored distribution (thermodynamic-equilibrium) of S^{34} were established between SO_4^{2-} and H_2S . It seems fairly certain that the biological sulfur cycle in nature provides a mechanism for the exchange of the sulfur isotopes between

SO_4^{--} and H_2S . The results indicate that autotrophic organisms, which oxidize H_2S , did not become significant before 700 to 800 million years ago. (auth)

4799

COMPARATIVE MEASUREMENTS OF STANDARDS FOR CARBON ISOTOPES. Willi Dansgaard. *Geochim. et Cosmochim. Acta* 3, 253-56(1953) July 7. (In English)

Measurements on two American, one Swedish, and one Danish carbon standard are reported. These measurements are intended to provide a direct comparison between American and Scandinavian measurements on carbon isotopes. CO_2 samples are used in the mass spectrometry, and it is shown that differences in O^{17} -abundance may cause measurable errors. (auth)

4800

THE MAXIMUM AGE OF THE ELEMENTS AND THE AGE OF THE EARTH'S CRUST. C. B. Collins, R. D. Russell, and R. M. Farquhar. *Can. J. Phys.* 31, 402-18(1953) April.

Estimates are given of a maximum time of formation of the elements of 5.5 billion years and of the time of formation of the earth's crust at 3.5 billion years. These estimates were based on the isotopic constitution of lead ores dated from isotopic analyses of radiogenic leads from U minerals. Methods of calculation are described. Experimental measurements of the isotopic constitution of lead from mass spectrograms of lead tetramethyl are reported with examples. (auth)

METALS AND METALLURGY

4801

Battelle Memorial Inst.

THE URANIUM-TITANIUM ALLOY SYSTEM. Murray C. Udy and Francis W. Boulger. Nov. 5, 1952. Decl. June 5, 1953. 18p. (AECD-3537; BMI-774)

A U-Ti constitution diagram is presented. There is complete solid solubility between Ti and gamma U above about 2100°F. Only one compound exists in the system. It has a hexagonal structure based on U_2Ti . It has a fairly wide range of stability, particularly on the Ti side. Beta-Ti solid solution decomposes eutectoidally into alpha Ti and compound at 1150°F. Eutectoid composition is about 72 at.% Ti. Gamma-U solid solution decomposes eutectoidally at 1325°F into beta U and compound. Eutectoid composition is about 6 at.% Ti. Beta U and compound react peritectoidally at 1233°F to give alpha U. Solubility of Ti in alpha and beta U is low as is the solubility of U in alpha Ti. (auth)

4802

Oak Ridge National Lab.

DISSOLUTION OF NaK. J. C. White, C. K. Talbott, and L. J. Brady. Dec. 2, 1952. Decl. June 11, 1953. 9p. (AECD-3538; ORNL-1453)

A rapid yet safe method for the dissolution of Na-K alloys prior to chemical or instrumental analysis has been devised. The alloy is submerged beneath the surface of an inert organic reagent and dissolved at a controlled rate by adding methanol drop-by-drop. A blanket of inert gas is maintained over the reaction flask. The procedure has been successfully used to dissolve samples of NaK in the range of 0.05 to 25 g. (auth)

4803

Illinois Inst. of Tech.

THE EFFECT OF DISSOLVED ELEMENTS ON THE RATE OF ISOTHERMAL GRAIN GROWTH IN METALS: FINAL REPORT. S. C. Huang and J. M. Lommel. June 12, 1953. 38p. (NP-4647)

Further studies of the isothermal grain growths of Fe-Ni and Fe-Cr alloys are reported. In the alloys studied the amount of added elements was less than the limit of solid solubility in alpha Fe. A treatment is described for breaking

down the alloy ingots (6 in. long and 2 in. diam), so as to produce a uniform grain size in the starting material. Specimens $\frac{1}{4} \times \frac{1}{4} \times 0.04$ in. were prepared for the grain-growth anneal, and annealing temperatures were chosen so that the alloys were in the alpha Fe field. After careful counting of the grain area, curves of log mean grain area vs. log annealing time were drawn. Results indicate that: (1) the alloying elements Ni and Cr refine the recrystallized grain size as compared with pure Fe under the same rolling and annealing operation, (2) Ni is more effective than Cr in refining the grain size, and (3) the rate of grain growth of Fe-Ni and Fe-Cr alloys is slower than that of pure Fe at the same temperature. (For preceding period see NP-4187.) (L.M.T.)

4804

[Atomic Energy Research Establishment, Harwell, Berks (England)]

NOTES ON THE HOT WIRE METHOD FOR DETERMINING THE THERMAL CONDUCTIVITY OF A METAL. D. V. Wordsworth. [nd] 29p. (AERE-E/M-52)

The theory of the hot-wire method for determining the thermal conductivity of a metal and the limitations imposed by the assumptions and approximation of the theory are discussed. The possibility of using a single power curve to determine both thermal conductivity and emissivity is investigated. Suggested modifications of the usual experimental methods include the obtaining of 2 power curves at the same temperature, one for the full length of wire and the other for $\frac{1}{2}$ the wire. (J.S.R.)

4805

Atomic Energy Research Establishment, Harwell, Berks (England)

TRANSFORMATIONS BETWEEN HEXAGONAL AND BODY CENTERED CUBIC LATTICES. PART 1. A CRYSTALLOGRAPHIC STUDY OF POSSIBLE ORIENTATIONS. J. W. Glen. PART 2. SOME ASPECTS OF THE CRYSTALLOGRAPHY OF ZIRCONIUM. S. F. Pugh. Feb. 1953. 34p. (AERE-M/R-1144)

Assuming that the orientation relations suggested by Burgers for the phase change in Zr apply, the possible orientations which can arise after one or two transformations of either a hexagonal or a body-centered cubic lattice are deduced, and their relative probability assessed. The effect of such transformations on specimens having a preferred orientation is also discussed. Part 2 contains a discussion of the changes in orientation of Zr crystals on annealing in the α and β range. The predictions of Glen in Part 1 are compared with experimental results and, in particular, are used to account for the orientation of crystals in crystal-bar Zr, and in rolled Zr strip annealed above the transformation temperature. (auth)

4806

Atomic Energy Research Establishment, Harwell, Berks (England)

THE METALLOGRAPHIC EXAMINATION OF HOT METAL SURFACES. B. W. Mott and S. D. Ford. May 12, 1953. 10p. (AERE-M/R-1184)

An apparatus is described for the microscopical examination of easily oxidized refractory metals at temperatures up to 1000°C. The difficulties associated with the technique are illustrated by a description of observations made on U, Be, and Zr. (auth)

4807

Armour Research Foundation

PHASE DIAGRAMS OF ZIRCONIUM-BASE BINARY ALLOYS, REPORT 10. THE ZIRCONIUM-OXYGEN SYSTEM, REPORT 4, SUMMARY. April 1, 1952-MARCH 31, 1953. Robert F. Domagala and Donald J. McPherson. Mar. 31, 1953. 57p. (COO-181)

Iodide Zr was combined with calculated amounts of ZrO_2 or master alloys and arc-melted. Annealing treatments were carried out at 22 temperature levels. Metallographic examination of the heat-treated specimens permitted construction of the binary phase diagram from Zr to ZrO_2 . Features of the diagram include the peritectic formation of β solid solution at 1940°C by the reaction $\text{L} + \alpha \rightarrow \beta$. The weight per cent compositions of the reacting phases are L: 1.25% O, α : 3.75% O, and β : 2.0% O. Alpha solid solution forms directly from the melt and has a maximum melting point at 5.5% O and 1975°C . The maximum solubility of O in alpha Zr is 6.75% and is apparently independent of temperature. A eutectic occurs at 11% O and 1900°C , whereby $\text{L} \rightarrow \alpha + \text{ZrO}_2$. The intermediate phase ZrO_2 , which melts at 2700°C , has a homogeneity range extending from 23% O at 1900°C down to about 25% O at 700°C . No other singular phase was found between Zr and ZrO_2 . The variation in lattice parameters of the α solid solution with O content was determined. (auth)

4808

Lewis Flight Propulsion Lab., NACA
EFFECT OF PRESTRAINING ON RECRYSTALLIZATION TEMPERATURE AND MECHANICAL PROPERTIES OF COMMERCIAL, SINTERED, WROUGHT MOLYBDENUM. Kenneth C. Dike and Roger A. Long. July 1953. 25p. (NACA-TN-2973)

Given three presumably identical lots of commercial, sintered, wrought Mo, the 1-hr recrystallization temperature of one lot remained above 2900°F by limiting the amount of effective prestraining to 35% or less. Different recrystallization temperatures were obtained in various atmospheres, the highest in A and the lowest in H. Metal thus fabricated and then stress-relieved possessed an ultimate tensile strength at room temperature with 10% of metal swaged 99% and also possessed equivalent ductility. At 1800°F , equivalent strength and ductility was obtained irrespective of the amount of swaging over the range of 10 to 99%. The amount of swaging greatly influenced the recrystallized grain size, but the difference in grain size is not the major controlling factor which determines whether recrystallized Mo is ductile or brittle at room temperature. (NACA)

4809

Battelle Memorial Inst.
TITANIUM BIBLIOGRAPHY, 1900-1951: 1952 SUPPLEMENT. Beverly J. Archer and Robert W. Gibson, comps. 1953. 55p. (NP-4363(suppl.))

A compilation from the 1952 open literature on Ti and Ti alloys is presented. Approximately 600 references are given. (J.S.R.)

4810

Massachusetts Inst. of Tech.

1. FUNDAMENTAL DEFORMATION CHARACTERISTICS OF 80 NICKEL-20 CHROMIUM ALLOY IN CREEP AT ELEVATED TEMPERATURES. 2. AGING IN NICKEL-CHROMIUM ALLOYS HARDENED WITH TITANIUM AND ALUMINUM PERIODIC STATUS REPORT [FOR] FEBRUARY 1953-MAY 1953. H. C. Chang, Rolf Nordheim, and N. J. Grant. 4p. (NP-4613; Periodic Status Report 3)

Two new furnaces, designed for the purpose of studying fundamental deformation characteristics of 80 Ni-20 Cr alloy in creep at elevated temperatures, are briefly described. A discussion of phase identifications on x-ray examinations of lump specimens is presented. The higher internal stresses caused by a greater misfit of the lattices explains the higher strength of alloys in which the Al is partly replaced by Ti. An explanation of the typical Widmannstätten structure of the aged ternary Ni-Cr-Ti alloys is made. It was found that variations in the C content had

only little influence on the aging behavior. However, the rupture strength was increased slightly by a moderate increase in the C content. (J.A.G.)

4811

Metals Research Lab., Graduate Div. of Applied Mathematics, Brown Univ.

ULTRASONIC ATTENUATION AND VELOCITY MEASUREMENTS IN COMMERCIAL PURE TITANIUM BEFORE AND AFTER HEATING IN HYDROGEN. Chung F. Ying and Rohn Truell. May 1953. 51p. (NP-4632; Technical Report 1)

The ultrasonic attenuation of commercially pure Ti and the velocity of propagation of ultrasound in it were measured at frequencies ranging from 10 to 50 mc. The same material was then heated in H for many hours at temperatures not higher than 550°C . The two ultrasonic quantities were again measured and were found to have changed remarkably especially when the metal had been heated at temperatures close to 550°C . In the latter case, long heavy lines appeared in the microstructures of the metal on heating. On being heated in H, the weight of the metal sample increased, but the size of the sample increased by a larger percentage; consequently, the density of the metal decreased, again remarkably when the sample had been heated in H close to 550°C . From the increase in weight, the H content of the sample was estimated. One sample was also outgassed after being charged with H. To determine the effect of heating alone, samples of the metal were heated respectively in vacuum, O, and N under similar conditions. No large changes in the attenuation, the velocity, and the microstructures were observed. The changes induced by the heating in H were believed to have resulted from the appearance of new Ti-H phases. In the case of small H content, H in solution may also have an effect. (auth)

4812

Horizons, Inc.

RATE OF DIFFUSION OF CARBON IN ALPHA AND IN BETA TITANIUM AS A FUNCTION OF THE TEMPERATURE AND CONCENTRATION; INTERIM TECHNICAL REPORT [FOR] PERIOD DECEMBER 12, 1952-MARCH 11, 1953. Eugene Bucur and F. C. Wagner. Apr. 13, 1953. 21p. (NP-4643; Interim Technical Report 1)

Preliminary results are presented on the C-Ti phase diagram and theoretical analysis of diffusion of C in α and β Ti. (L.T.W.)

4813

Rensselaer Polytechnic Inst.

ANISOTROPIC DIFFUSION: PROGRESS REPORT. H. B. Huntington, G. A. Shirn, and E. S. Wajda. [July 1, 1953] 22p. (NYO-894; Progress Report 2)

Experimental determinations of the lattice self-diffusion in Cd and of the grain-boundary self-diffusion in Zn are reported. Results from the Zn experiments show that the grain-boundary activation energy is less than that for lattice diffusion, giving a larger self-diffusivity for the grain-boundary over the pure lattice self-diffusion. Considerable discussion is devoted to an interpretation of the temperature-independent factor in the general theory of solid diffusion. (For preceding period see NYO-893.) (L.M.T.)

4814

Massachusetts Inst. of Tech.

SOLID SOLUTIONS AND GRAIN BOUNDARIES: TECHNICAL PROGRESS REPORT NO. 16, SCOPE 2. B. L. Averbach, M. Cohen, W. F. Flanagan, F. Herbstein, J. Hilliard, P. S. Rudman, and E. E. Underwood. June 30, 1953. 4p. (NYO-3819)

The nature of solid solutions is investigated by means of x-ray and thermodynamic methods. Diffuse x-ray scattering measurements are used to provide information relative to

the average identity of nearest neighbors and the average sizes of the atoms in solid solution. The alloy systems are chosen so that the thermodynamic activities can also be measured. An effort is being made to establish a statistical model of solid solutions that can correlate the x-ray and thermodynamic measurements. (auth)

4815

Armour Research Foundation
EXPLORATION OF VANADIUM BASE ALLOYS. W. Ros-
toker, D. J. McPherson, and M. Hansen. May 1953. 66p.
(WADC-TR-52-145)

An annual report is presented, summarizing the results of work directed toward the development of V-base alloys. The alloying characteristics of V with twenty-one solute elements were studied in sufficient detail to provide information on solubility limits, first intermediate phases, and reaction between the solid solution and the first intermediate phase. The development of hot forging, annealing, scalping, and rolling practices has been pursued. A large number of alloys have been successfully forged. The oxidation characteristics of V alloys have been examined. It has been demonstrated that oxidation behavior is primarily controlled by the presence or absence of molten V_2O_5 . Several alloy additions appear to raise the melting point of this oxide. (auth)

4816

Wright Air Development Center
POWDER-FABRICATED MAGNESIUM ALLOYS. PART 1.
DEVELOPMENT OF HIGH-STRENGTH SHEET FROM
POWDER-FABRICATED Mg ALLOYS CONTAINING Zn, Zr,
AND Al. H. A. Johnson, ed., Wright Air Development
Center and Dow Chemical Co. Jan. 1953. 116p. (WADC-
TR-53-18(pt.1))

High-strength sheet has been produced through development of rolling techniques for ZK + A20 powder extrusions. Excellent properties and rollability have been obtained by rapidly heating ZK60 powder extrusions to the rolling temperature, hot rolling in one heat, and warm rolling to the desired gage. High-quality ZK60 powder fabrications which have corrosion rates equal to those of billet material have been produced. Illustrative properties of ZK60 sheet hot-rolled on the 8-in. mill under the above technique are compared with typical values of FS-H24, the present high-strength commercial sheet alloy. (auth)

4817

Wright Air Development Center
POWDER-FABRICATED MAGNESIUM ALLOYS. PART 2.
LARGE-SCALE EXTRUSION OF ZK60A ALLOY POWDER.
H. A. Johnson, ed., Wright Air Development Center and
Dow Chemical Co. Jan. 1953. 48p. (WADC-TR-53-18(pt.2))

Approximately 7000 pounds of ZK60A alloy powder have been extruded into various shapes on production equipment. A kiln-type powder heater, a portable powder loader, and a small extrusion-container extension have been constructed and operated. Other equipment necessary for production extrusion of ZK60A alloy powder has been studied. It has been demonstrated that high-purity ZK60A alloy powder possesses a corrosion rate similar to that of billet extrusions, and that blisters are caused by flux and rust inclusions. The best method of eliminating blisters is screening the powder to -20 mesh, and heating it to 650°F prior to extrusion. (auth)

4818

Armour Research Foundation
BRAZING AND SOLDERING OF TITANIUM AND ITS AL-
LOYS: FINAL TECHNICAL REPORT [FOR] SEPTEMBER
1, 1951-JANUARY 31, 1953. 118p. (WAL-401/96-15)

The fundamental factors involved in making a brazed or soldered joint between Ti and Ti or other metals have been

studied and methods evolved for making brazed lap joints by heating with an oxyacetylene torch, by means of electric resistance, and in an inert atmosphere furnace. Methods were also developed for soldering Ti with a soldering iron. The nature of Ti surface films has been studied and metal-depositing fluxes formulated for removing them. $AgCl$, Cu_2Cl_2 , $MnCl_2$, or $SnCl_2 \cdot 2H_2O$ alone or with alkali and alkali-earth fluorides and chlorides react with the Ti. When these salts were fused on a Ti surface, the surface film was undercut, and a metal film was deposited in a reaction taking place below the melting point of the deposited metal. Braze metals wet and flow on flux-deposited metal films of Ag, Cu, and Mn. Pb-Sn solders also wet and flow on flux-deposited metal films of Ag, Cu, and Sn. Joints brazed with fine Ag break with a ductile shear fracture at approximately 30,000 psi shear strength. To explain this unique combination of joint properties, a tentative Ti-Ag binary phase diagram was established which showed one intermetallic compound, TiAg. This compound is unique in that it is highly ductile, thus accounting for the ductility in brazed joints made with fine Ag. Other braze metals, with the possible exception of Ag-Cd and Ag-Zn alloys, form brittle intermetallic compounds with Ti and produce brittle joints. Recrystallization bonding of Ti has produced high-strength lap joints. (auth)

4819

Columbia Univ. School of Engineering
RESEARCH ON THE EFFECT OF PLASTIC DEFORMATION
ON TRANSFORMATION IN TITANIUM ALLOYS; INTERIM
TECHNICAL REPORT No. 1. Mar. 1953. 18p. (WAL-401/
148-7)

Le Chatelier's Principle is applied to stress-induced displacive (martensitic) transformations involving a homogeneous deformation, and the validity of the predictions is illustrated, using experimental data obtained from a 9% Mo-Ti alloy. (L.T.W.)

4820

ON A "NEW" MECHANISM OF PLASTICITY OF METAL-
LIC SOLID SOLUTIONS. K. A. Osipov, S. G. Fedotov, and
M. G. Lozinsky. Translated from *Doklady Akad. Nauk*
S.S.S.R. 89, 57(1953). 5p. (NSF-tr-19; D-89-57)

Cu-Sn alloys containing 2, 5, 8, and 12% Sn were melted and annealed at 650 to 700°C for 360 hr. After this annealing, deep etching and micro x-ray analysis failed to reveal any nonhomogeneous distribution of the components. Cylindrical samples with polished end surfaces were then prepared from nondeformed annealed alloys and annealed again in vacuum at 700°C for 6 hr. After the vacuum annealing, microscopic analysis revealed large homogeneous grains in the microsection of the samples. The samples were tested for hardness during heating from 20 to 800°C at sequences of 20, 200, 350, 500, 600, 700, and 800°C. A plot of the log of hardness against temperature shows a linear relationship below 425 to 525°C, but a very sharp drop in the log of hardness at higher temperatures. These deviations from linearity were found to coincide with changes in microstructure. In the range below 425 to 525°C, impressions showed slip bands together with clearly outlined boundaries of the large grains of the alloy which had formed at higher temperatures as a result of annealing. In impressions taken at higher temperatures no slip bands were observed, but great numbers of small cells considerably smaller than the original coarse grains were noted. The authors feel that the mechanism of high-temperature plastic deformation is connected with the viscous behavior of these materials at the separating surfaces. (L.M.T.)

4821

ZIRCONIUM: A STRUCTURAL MATERIAL FOR NUCLEAR
REACTORS. E. C. Miller. *Nucleonics* 11, No. 7, 27-31
(1953) July.

Information relative to separation of Hf and Zr, location of raw materials, production and fabrication of Zr metal, Zr alloys, and corrosion resistance of metal and alloys is summarized. Physical properties of Zr are tabulated. (L.T.W.)

4822

X-RAY INVESTIGATION OF THE AGING OF Al-Zn ALLOYS. A. M. Elistratov. *Doklady Akad. Nauk S.S.S.R.* **88**, 803-6 (1953) Feb. 11. (In Russian)

Al-Zn alloy (25 wt. % Zn) in the form of wire, 0.1 to 0.5 mm in diameter, was annealed for 2 hr at 440°C, and tempered in ice water. The change in the structure of the γ phase was then investigated with x rays. Appearance of straight and curved bands, crossing the fine structure of the grain, was the most obvious change. The parameters of the crystal structure were measured. (J.S.R.)

4823

THE ETTINGHAUSEN EFFECT IN Bi-Pu ALLOYS. B. Neumann and K. M. Koch. *Z. Naturforsch.* **a8**, 331-2(1953) May. (In German)

The Ettinghausen effect in Bi-Pu alloys has been measured at room temperature. The alloys with low Pb concentration showed a negative temperature coefficient at $\sim 80^\circ\text{K}$, while the high Pb alloys had a negative temperature coefficient at room temperatures. (J.S.R.)

4824

MICROGRAPHIC DETERMINATION OF GRAIN SIZE IN ALUMINUM AND ITS ALLOYS. Jean Herenguel. *Rev. aluminium* **29**, 321-9(1952) June. (In French)

A method for determining grain size in Al and Al alloys is described which uses a chemical treatment technique to expose the intergranular boundaries and grain orientation. Electrolytic polishing eliminates the work-hardened film which covers the surface after mechanical polishing. (K.S.)

4825

ELECTRON-MICROSCOPIC EVIDENCE OF A FINE SUBSTRUCTURE OF THE CRYSTALS OF ALUMINUM AND ITS ALLOYS. Pierre Bussy and Georges Chaudron. *Compt. rend.* **236**, 2323-5(1953) June 15. (In French)

With an electron microscope very fine structure is visible on Al and its alloys. This structure is particularly obvious on the Al-Cu alloy containing 0.5 to 4% Cu. It has the appearance of extremely fine furrows, and the regularity and orientation of the furrows bear a direct relation to the orientation of the crystals on which they appear. The distance between them remains constant from one crystal to the next and is between 900 and 1200 Å. In a few crystals there are no furrows but a structure with polygonal contours. The structure appears to correspond to a different orientations of crystal support. (J.S.R.)

PHYSICS

4826

Brookhaven National Lab.

QUARTERLY PROGRESS REPORT [FOR] JANUARY 1-MARCH 31, 1953: UNCLASSIFIED SECTION. 44p. (BNL-232)

Abstracts are given for activities being reported concurrently in the scientific journals. The abstracts of reports cover work of the physics, instrumentation, health physics, reactor, nuclear engineering, and biology departments. (For preceding period see BNL-219.) (J.E.D.)

4827

Ames Lab.

SPECTRAL AND TOTAL EMISSIVITY: A GUIDE TO THE

LITERATURE (1910-1951). Maynard P. Bauleke. June 1, 1953. 41p. (ISC-364)

An annotated bibliography, compiled to serve as a guide to the literature of 1910-1951 on the theory and methods of determining spectral and total emissivity is presented. The notations are arranged according to three broad subject headings: general, non-metal, and metals. (auth)

4828

Louisiana State Univ.

THEORY OF ELECTROLYSIS AT CONSTANT CURRENT IN UNSTIRRED SOLUTION. 1. APPLICATION TO THE STUDY OF COMPLEX IONS. Paul Delahay and Talivaldis Berzins. Dec. 1952. 42p. (NP-4593(pt.1); Technical Report 10)

A mathematical analysis is made for the potential-time curves which are observed in electrolysis at constant current with mass transfer partially or totally controlled by semi-infinite linear diffusion. Three cases are considered: 1. Reversible electrochemical process; 2. Irreversible electrochemical process; 3. Electrochemical process preceded by a first-order chemical reaction. The potential-time curves are characterized by a transition time whose value is derived for the above three cases. The transition time for given conditions of electrolysis is the same whether the electrode process is reversible or irreversible (cases 1 and 2). In the third case mentioned above, the transition time depends on the kinetics of the reaction preceding the electrochemical process. Conditions under which the theoretical treatment can be applied to the reduction of complex ions are stated. It is shown that for certain complexes (cadmium cyanide) dissociation must precede the electrochemical reaction, whereas other complexes (copper ethylenediamine) are reduced directly. The rate of recombination of Cd^{++} and CN^- ions is evaluated as being of the order of 4×10^8 (moles/l.) $^{-1}$ sec $^{-1}$. Experimental methods are briefly discussed, and the potentialities of the method as a tool in electrochemical studies are evaluated. (auth)

4829

Louisiana State Univ.

THEORY OF ELECTROLYSIS AT CONSTANT CURRENT IN UNSTIRRED SOLUTION. 2. CONSECUTIVE ELECTROCHEMICAL REACTIONS. Talivaldis Berzins and Paul Delahay. Mar. 1953. 47p. (NP-4593(pt.2); Technical Report 13)

A rigorous mathematical analysis is presented for the following types of electrode process in electrolysis at constant current in unstirred solution: 1. Cathodic process followed by re-oxidation resulting from reversal of the current through the cell; 2. Reduction of a two-component system; 3. Stepwise reduction of a single substance. The concentrations of the substances involved in the electrode process are derived by applying the method of integral transforms (Fourier and Laplace), and the corresponding transition times are calculated. Equations of the potential-time curves are also derived for cases I and III. In case I, the transition time for the re-oxidation process is one-third of the transition time for the preceding cathodic process. The analysis of the potential-time curve enables one to make a complete study of the kinetics of the electrode process when this process involves cathodic and anodic overvoltages exceeding 0.1 v: calculation of the rate constant at zero potential, determination of the transfer coefficient, calculation of the free energies of activation for the forward and backward electrochemical reaction, and computation of the standard potential for the couple involved. In case II, the transition time for the substance which is the more difficult to reduce, depends not only on the bulk concentration of this substance, but also on the concentration

of the substance being reduced at less cathodic potentials. Quantitative relationships between the transition times for the two steps are derived. (auth)

4830

Research Lab. of Electronics, Mass. Inst. of Tech.

QUARTERLY PROGRESS REPORT [FOR PERIOD ENDING FEBRUARY 28, 1953]. J. B. Wiesner, G. G. Harvey, and H. J. Zimmermann. Apr. 15, 1953. 104p. (NP-4645)

Further studies are reported on the electrical effects of temperature gradients imposed across the system Ag-AgCl-Ag. Microwave gaseous discharge studies included: plasma electron oscillations in a spherical Hg discharge tube; microwave breakdown in H at high pressures; and measurement of σ_r/σ_i , the ratio of the real to imaginary part of the electric conductivity, and the electron density as functions of time in the afterglow of a He pulsed discharge. The dielectric coefficient of Ge in the 10-cm region was measured using the resonant-cavity technique. The modification of the liquid-He viscometer is described. Microwave spectroscopy studies include: electric dipole moments of $K^{39}Cl^{35}$ and $Na^{23}Cl^{35}$ from Stark-effect patterns; the quadrupole fine structure of CH_3I^{127} ; and preliminary calculations of the theoretical Zeeman splittings in O_2 gas. A new method is proposed for examining the hfs and isotopic shifts of absorption lines and application is made to Hg. Microwave tube research and transmission studies include: apparatus for measuring noise output in electron beams; design and performance of a backward-wave oscillator tube; testing of internally coated-cathode diode-type tubes; investigation of a strip transmission system; and study of the impedance matrix of a cavity with a generalized medium. Various aspects of studies in communications systems are summarized. Construction and operation of scale-of-10 counters from binary units are described. The performance of transistors in amplifiers, oscillators, and receivers is discussed. (For preceding period see NP-4347.) (L.M.T.)

4831

Applied Science Research Lab., Univ. of Cincinnati

THE SURFACE AREA OF CARBON BLACKS; A STUDY OF POROUS MEDIA BY MEANS OF FLOW METHODS. Gerard Kraus and John W. Ross. June 30, 1953. 23p. (NP-4651; Technical Report 2)

Steady-state gas flow rates have been determined on 7 C blacks ranging in BET surface area from 16 to 156 m²/g. The Knudsen flow areas have been computed and are found to be in good agreement with both the BET and electron micrograph areas in all cases where there is no evidence of blind pores. Where blind pores are suggested by discrepancies between BET and electron micrograph areas or by adsorption hysteresis, the Knudsen flow area is found to be intermediate between these two surfaces, but appears to lie nearer to the BET value. Attempts to deduce surface areas of physical significance from the slopes of the permeability functions have been unsuccessful. In the course of the above measurements there arose a question as to uniformity of packing and its effect on the calculated surface area. Experiments under various densities of packing have been performed which suggest that below a porosity of 0.60, no serious difficulties are to be expected. Transient-state flow measurements on C blacks lead to surface areas which are in general accord with earlier results. However, the agreement with independent methods is not as good as with coarser powders, and the reproducibility of measurement is less than for the steady state determination. (auth)

COSMIC RADIATION

4832

Iowa State Univ.

INTEGRATED COSMIC RAY INTENSITY AS A FUNCTION

OF ALTITUDE (thesis). Ernest Clark Ray. June 1953. 51p. (SUI-53-5)

A new method for measuring the number of cosmic-ray particles passing through a sphere of unit cross section per unit time has been devised, using simultaneously two single geiger counters, one with its axis horizontal and the other with its axis vertical. Three balloon flights were made with this system at geomagnetic latitude $\lambda = 52^\circ N$, using counters with a wall thickness of 30 mg/cm². The value obtained for the integrated omnidirectional intensity is significantly higher than that of previous workers who made the measurement with telescopes having considerably more absorber. The present value at the Pforter maximum is 3.4/cm²/sec. This difference is well outside of experimental errors. A brief discussion is given of work under way to be used with this result for an independent determination of the ionization produced in unit volume of standard atmosphere per second. (auth)

4833

THE STRUCTURE OF ABNORMALLY WIDE ATMOSPHERIC SHOWERS OF COSMIC RADIATION. D. V. Skobel'tsyn and G. T. Zatsepin. Translated by G. Belkov from Doklady Akad. Nauk S.S.S.R. 73, 1157-60(1950). 10p. (AEC-TR-1571; TT-369)

An abstract of this material appears in Nuclear Science Abstracts as NSA 4-6644. (C.H.)

4834

MODELS OF V-PARTICLES. Kazuhiko Nishijima. Progr. Theoret. Phys. (Japan) 9, 414-30(1953) Apr.

Possible models of V particles, mainly concerned with V^0 (V_1^0) particles, are investigated in a systematic way on the basis of their characteristic features, one being experimental evidences and the other theoretical requirements such as the stability of nuclei and the charge independence. The latter play a role for ruling out a proposed decay mode, $V^0 \rightarrow p + \pi^- + \nu$, and the single production of hot V^0 particles, respectively. Since the pair production of V^0 particles seems unfavorable according to recent experimental evidences, a proposed model is based upon the classification of elementary particles due to the generalization of the Pais even-odd rule. (auth)

4835

THE DECAY OF A NEUTRAL V PARTICLE INTO TWO MESONS. B. Dayton and D. Willard. Phys. Rev. 91, 348-50(1953) July 15.

An unusual example of the decay of a V^0 particle has been observed in a multiplate cloud chamber operated at 10,600 feet. From this event, it is uncertain if the decay is a two- or three-body process, though in either case neither of the charged decay products can be as heavy as a proton. If a two-body decay is assumed, the event may be completely and consistently described according to either of the following decay schemes: $V_2^0 \rightarrow \pi + \pi + Q$, $V_2^0 \rightarrow \pi + \mu + Q$. The corresponding Q values are approximately 185 and 150 Mev, respectively. (auth)

4836

STUDY OF NEUTRAL V PARTICLES OBSERVED IN A MULTIPLATE CLOUD CHAMBER. H. S. Bridge, C. Peyrou, B. Rossi, and R. Safford. Phys. Rev. 91, 362-72(1953) July 15.

In a series of pictures taken with a multiplate cloud chamber, the decay of a number of V^0 particles which originated in nuclear interactions produced inside the cloud chamber were observed. Most of these particles were found to decay into a proton and a π meson with a Q value of 37 Mev. Strong evidence is presented to support the hypothesis that no neutral secondary particle is produced. The lifetime was found to be $3.5 \pm 1.2 \times 10^{-10}$ sec. Four V^0 particles were found which certainly belong to a different group. The de-

cay products of these particles are probably two π mesons. The nature and energy of the nuclear interactions which produce V^0 particles are discussed. (auth)

4837

A CLOUD-CHAMBER STUDY OF NEUTRON PRODUCTION BY SEA-LEVEL COSMIC RAYS WITH PARTICULAR REFERENCE TO μ -MESONS STOPPED IN LEAD. E. J. Althaus and R. D. Sard. *Phys. Rev.* **91**, 373-84(1953) July 15.

A multiplate cloud chamber has been used at sea level to test the conclusion drawn from counter experiments that neutrons of several-Mev energy are liberated when negative μ mesons are stopped in Pb. The stopped mesons are recognized by comparison of visually estimated ionization and range. With the plate thicknesses used, mesons can be distinguished from electrons and protons. To discriminate against π mesons, which would have to be produced locally, there is a minimum of condensed material above the chamber, and mesons accompanied by any other particle in the top compartment are excluded from the statistics. Alternate plates of Pb and C of equal stopping power are used, evaporation neutrons being expected from mesons stopped in the Pb but not from mesons stopped in the C. The chamber is surrounded by paraffin and BF_3 counters, for the detection of neutrons originating in the plates; a G-M tube telescope above the chamber selects charged particles directed through the chamber. The chamber is expanded when a telescope coincidence is associated with at least one detected neutron. In 1207 accepted pictures, there are 14 definite cases of mesons stopping in the Pb, none of mesons stopping in the C. Including probable as well as definite identifications, the corresponding numbers are 19 and 1. These results confirm the production of evaporation neutrons in μ -meson capture in Pb. The large Pb:C ratio shows that π -meson contamination is negligible when suitable selection criteria are used. The neutron coincidence pictures reveal the various processes giving rise to these events. Electronic showers account for a large fraction; the "giant resonance" of 15-Mev photons in Pb is probably responsible. About 20% of the events are energetic nuclear interactions. There is a significant yield of single penetrating particles, some of which must be fast μ mesons interacting in Pb with small energy loss. The rate is consistent with underground measurements of the neutron yield. A V^0 decay has been found with both branches heavily ionizing; it appears to be a V^0 with Q in the range 30 to 55 Mev. (auth)

4838

COSMIC RADIATION INTENSITY-TIME VARIATIONS AND THEIR ORIGIN. II. ENERGY DEPENDENCE OF 27-DAY VARIATIONS. William H. Fonger. *Phys. Rev.* **91**, 351-61 (1953) July 15.

Cosmic-ray intensity-time variations recorded in the lower atmosphere by one neutron detector (D-1, Climax, Colorado) and three ionization detectors (Freiburg, Germany; Cheltenham, Maryland; and Huancayo, Peru) are compared. Irregular intensity variations characterized by time parameters of 27 days and 24 hours are shown to occur in coincidence in the records of both types of detectors. It seems reasonable to ascribe correlated neutron and ionization-intensity variations to a common origin. It has been shown that 27-day neutron intensity variations are produced by primary intensity variations. The magnitude of these variations must be greater for low-energy primaries as 27-day neutron intensity variations at Climax are ~ 5 times larger than corresponding ionization intensity variations at Freiburg, Cheltenham, and Huancayo. These variations must extend, however, to high-energy primaries, as their effects are observed at the geomagnetic equator. From the $\sim 5:1$ relative response (Climax neutron to northern sea-level ionization detector) one parameter de-

scribing the energy dependence of 27-day primary intensity variations can be empirically evaluated. Assuming a power law similar to that describing the energy dependence of the time-average primary intensity spectrum, it is found that the amplitude of 27-day primary intensity variations is required to decrease with increasing primary energy approximately one power of energy more rapidly than the time-average primary spectrum itself. The electric-field-acceleration-process hypothesis predicts primary intensity variations with approximately this energy dependence. Twenty-four-hour neutron (Climax) and ionization (Freiburg intensity variations are correlated in local time. It is not certain that these variations are produced by primary intensity variations. Even if this were the case, the relative response (Climax to Freiburg) to such primary intensity variations cannot be accurately determined from the data studied here. (auth)

4839

SPECTRAL ANALYSIS OF THE DISTRIBUTIONS OF THE ANGULAR INTENSITY AND OF THE EAST-WEST ASYMMETRY OF THE NUCLEAR COMPONENT OF COSMIC RADIATION DONE WITH A SENSITIVE EMULSION. Tsai-Chü and Max Morand. *Compt. rend.* **236**, 2311-13 (1953) June 15. (In French)

A formula is given for the calculation of the zenithal distribution, which can be expressed by $j(\theta) = j(0)\cos^{\lambda}\theta$, with $\lambda = 1.57 \pm 0.14$ for all particles; λ increases with the energy. (tr-auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

4840

GROUP THEORY AND QUANTUM MECHANICS OF THE STRUCTURES OF TRANSITION METALS. K. Ganzhorn. *Z. Naturforsch.* **a8**, 330-1(1953) May. (In German)

The crystal structure of the transition elements is discussed on the basis of group theory and quantum mechanics. The crystal configuration is dependent on the state of the d-electron. (J.S.R.)

ELECTRONS

4841

ADDITIONAL MEASUREMENTS ON THE SINGLE SCATTERING OF ELECTRONS BY ATOMIC NUCLEI. E. Kinzinger. *Z. Naturforsch.* **a8**, 312-15(1953) May. (In German)

Experiments on the single scattering of electrons in atomic nuclei in the 100-kev range are described. The deviations of the ratio of the effective cross section of Al/Au from the Mott value were found to be constant in the energy range of 150 to 400 kev with a 120° scattering angle. The distribution of electrons scattered by the Al and Au formed a smooth curve without sign of interferences. (tr-auth)

INSTRUMENTS

4842

Argonne National Lab.
A METHOD FOR STABILIZING SCALING CIRCUITS. Jerome L. Lerner. June 5, 1953. 8p. (ANL-5072)

The stability of the usual binary scaling stage is improved by the use of SiC nonlinear resistors in the plate-to-grid coupling circuits. The nonlinear characteristics of these resistors permit a larger fraction of the plate-voltage swing to be applied to the opposite grid, thus allowing longer tube life under conditions of low filament emission. The modification permits increasing the speed of the scaler for the same tube life expectancy. (K.S.)

4843

Hanford Works
AN AUTOMATIC PHOTOMETER. W. N. Carson, Jr. and

C. E. Michelson. Apr. 30, 1953. 17p. (HW-27744)

Design of an automatic photometer is described for particular applications to rapid sampling of radioactive KMnO_4 solutions. Design criteria are based primarily upon the problems of cell-window radiation darkening, the need for cell calibration and cell standardization, cell cleaning and decontamination, and the removal of gas bubbles from the light path. The associated remote-control and recording equipment are described. Accuracy of $\pm 1/2\%$ was achieved for the range 0.002 to 0.05M KMnO_4 . (K.S.)

4844

Servomechanisms Lab., Mass. Inst. of Tech.
ELECTRONIC NUCLEAR INSTRUMENTATION GROUP
ANNUAL PROGRESS REPORT [FOR PERIOD ENDING]
MARCH 1, 1953. T. S. Gray and A. B. Van Rennes. 60p.
(NP-4646)

The requirements imposed on neutron detectors and associated instrumentation by the high neutron flux and temperatures encountered in most reactors are studied. A rapid-response neutron thermopile detector is described. Two designs, using B_4^{10}C as a neutron flux-to-heat converter, are shown to satisfy these requirements. Temperature variation of the dielectric constant was found too large for practical design of dielectric amplifiers. The limitations and applicability of transistors in the design of several amplifier circuits and a counting rate meter are considered. The theory and design of several magnetic modulators are presented. Similar treatment is given to a magnetic cross-valve amplifier and transistor-controlled magnetic amplifiers. Feedback and filtering is applied to such amplifiers for rapid-response, linear operation. Analysis of a reactor power-level-period meter is given. An improved technique is described for grid-cathode capacitance compensation in pulse-height selectors. Pulse-height analyzers for low-level neutron fluxes are considered. Factors influencing the use of 35-mm film as a data storage medium rather than multichannel selectors are discussed. Analysis of the film by a photoelectric scanner gives good reliability. (K.S.)

4845

Atomic Energy Project, Univ. of Calif., Los Angeles
COUPLED THROUGH-FOCUS CONTROL FOR THE RCA
TYPE EMU-28 ELECTRON MICROSCOPE. F. W. Bishop
and M. L. Cook. Issued June 25, 1953. 8p. (UCLA-261)

A switching device and circuit is described which, by utilizing the photographic plate-advancing mechanism, causes the objective current in the electron microscope to increase by a small increment for each position of the five-exposure plate. By greatly shortening the time required to make a through-focus series of exposures as compared with the manual method, it minimizes the difficulties caused by the natural drift in the instrument and permits duplication of technique in succeeding plates. (auth)

4846

INVESTIGATIONS INTO THE RADIOACTIVE BACKGROUND
RADIATION AND ITS EFFECT. A. Sittkus, D. Ganz, and
E. Remy. *Z. Naturforsch.* **a8**, 317-22(1953) May. (In German)

An estimation of the effects of radioactive background radiation on measurements made with ionization chambers and single counter tubes shows that fluctuations in the air and soil radiation can cause variations in the zero adjustment up to 100% in an unshielded apparatus. Behind 50 g/cm² of shield the effect is up to 10%. With 100 g/cm² the effect is in general negligible. The estimation was made chiefly by measurement of the activity of fresh snow and rain water. An evaluation of the estimation can only be made after complete knowledge of the soil conditions, air composition, and radioactive impurities in fresh precipitate is known. (tr-auth)

4847

A COUNTING RATE METER FOR RECORDING OF THE
COSMIC-RAY INTENSITY, AND SOME GENERAL RE-
MARKS ON THE STATISTICS OF THE RATEMETER.
Harald Trefall. *Univ. Bergen Årbok, Naturvitenskap.*
Rekke, Paper No. 3(1952) 15p.

A counting ratemeter has been built for recording the cosmic-ray intensity, taking due regard to the low intensity, to its small variations, and to the long recording time necessary to obtain statistically significant results. The operation of the ratemeter is described. The greatest difficulty was to obtain the great stability needed. The mathematical connection between the recorded output and the counting rate is derived. The statistical properties of the ratemeter are studied. The cumulative function of the output is found and is used in the study of the distribution function. (auth)

4848

REALIZATION OF AN APPARATUS FOR THE DETAILED
INVESTIGATION OF NUCLEAR TRACKS OF ALL DENSITIES. Lud van Rossum. *Compt. rend.* **236**, 2234-6(1953) June 8. (In French)

A photometric installation for reproducible measurements of all properties of nuclear tracks is described. The image of the track, enlarged by a microscope, is formed in the plane of a slit which is in front of a photomultiplier. The operation is discussed. The problem of lighting for dense plates has been solved by application of a correction factor for the transverse profile. The factor is obtained by taking into account the variation of the contrast of the image with the depth of the track in the emulsion. (J.S.R.)

ISOTOPES

4749

Atomic Energy Research Establishment, Harwell, Berks
(England)
AN ISOTOPE HANDLING CALCULATOR. R. West. Apr.
30, 1953. 6p. (AERE-I/R-1063)

The report describes a calculator which at a single setting interrelates the following values: source strength, γ dose rate, distance from source, and screening by Pb. Direct-reading values are given for the isotopes Na^{24} , Co^{60} , Ra or Rn, Ta^{182} , Ir^{192} , Au^{198} , and I^{131} . The calculators are obtainable from the Isotope Information Office, Harwell, England. (auth)

4850

Brookhaven National Lab.
RUTHENIUM ISOTOPE ABUNDANCES. Lewis Friedman
and A. P. Irsa. [1952] 7p. (BNL-1488)

Using a Nier-type mass spectrometer with ruthenocene, $\text{C}_{10}\text{H}_{10}\text{Ru}$, as a source of ions, the mass and relative abundance of the Ru isotopes were found as follows: 96, 5.50; 98, 1.91; 99, 12.70; 100, 12.69; 101, 17.01; 102, 31.52; and 104, 18.67. (J.A.G.)

4851

ISOTOPIC ENRICHMENT BY MIGRATION IN A SOLID SUB-
JECTED TO AN ELECTRIC FIELD. Marius Chemla and
Pierre Sue. *Compt. rend.* **236**, 2397-9(1953) June 22.
(In French)

A mixture of the radioactive isotopes Na^{22} and Na^{24} in NaCl and KCl crystals is forced to migrate under the action of an electric field. The crystals are then cut into successive layers, and the quantities of Na^{22} and Na^{24} are measured in each. After a migration an enrichment of Na^{24} of 10 to 20% is observed in the deepest layers. (tr-auth)

4852

A SIMPLE RADIOMETRIC METHOD FOR THE DETER-
MINATION OF THE ISOTOPIC COMPOSITION OF
LITHIUM SALTS. Wilfrid Herr. *Z. Naturforsch.* **a8**,
305-7(1953) May. (In German)

A method for the determination of the isotopic ratio in Li is described. The Li sample, converted to LiCO_3 , and a standard are bombarded with neutrons and photographed on a nuclei emulsion. The plate is then developed and photometered. (tr-auth)

4853

IS THE ABUNDANCE RATIO OF CARBON ATOMS ALTERED BY COALIFICATION? Frans E. Wickman. *Geochim et Cosmochim. Acta* 3, 244-52 (1953) May. (In German)

Three series of coal samples representing Pliocene, Wealden, and Carboniferous have been investigated. Metamorphism has no traceable influence on the $\text{C}^{12}/\text{C}^{13}$ ratios. Various factors are briefly discussed in order to explain the observed isotope ratios. Often carbonates in coal do not seem to have been formed from plant CO_2 which is contrary to common views on their origin. (auth)

MATHEMATICS

4854

Los Alamos Scientific Lab.

HEURISTIC STUDIES IN PROBLEMS OF MATHEMATICAL PHYSICS ON HIGH SPEED COMPUTING MACHINES. John Pasta and S. Ulam. June 9, 1953. 26p. (LA-1557)

The value of electronic computers, in performing the model calculations applied in special cases of partial differential equations, is studied. Emphasis is placed on the application of computers to the functionals of representative problems rather than a complete solution at particular points. Problems were restricted to those where results were obtainable from a few hours of preparation and computing, such as the instability and mixing of gases, space transformations of an expanding sphere, moments of forces exerted by random points, and magnetic lines of force due to given currents in space. In most cases, results are obtained after 100 machine cycles. (K.S.)

4855

Institute of Rate Processes, Univ. of Utah

TABLES OF QUANTUM MECHANICAL INTEGRALS. 1. SOME TWO PARAMETER INTEGRALS. C. J. Thorne, R. S. Barker, and Henry Eyring. May 15, 1953. 38p. (NP-4637; Technical Report 1)

Variational methods are applied to the quantum mechanical expression for the energy of the triatomic hydrogen complex. The hamiltonian for H_3 is derived and, by selection of suitable coordinates, the expression for E reduces to 20 integrals. Tables are presented for values of the seven two-parameter integrals. (K.S.)

MEASURING INSTRUMENTS AND TECHNIQUES

4856

Los Alamos Scientific Lab.

RESPONSE OF THE LONG COUNTER. R. A. Nobles, Robert B. Day, R. L. Henkel, G. A. Jarvis, J. L. McKibben, R. P. Kutarnia, J. E. Perry, Jr., and R. K. Smith. [1953] 7p. (AECU-2594; LADC-1427)

The response of the long counter has been investigated with calibrated neutron sources having average energies up to 5 Mev and has been found to be flat down to a low-energy limit that is determined by the construction of the counter. A closer examination reveals fluctuations in the sensitivity of about 5% which occur at resonances for neutron scattering by C. One can account qualitatively for these fluctuations in terms of the scattering properties of the C present in the paraffin moderator of the counter. (auth)

4857

Atomic Energy Research Establishment, Harwell, Berks (England)

THE INTENSITY OF BETA ACTIVITY FROM THICK SOURCES. G. N. Walton, J. S. Thompson, and I. F. Croall.

Mar. 5, 1953. 30p. (AERE-C/R-1136)

The intensity of hard β activity as counted in an end-window counter normal to the surface of spread sources is shown to increase rapidly as the thickness of a very thin layer increases. The increase is greatest when the source is mounted on distrene, less when mounted on aluminum, and almost nil when mounted on lead. The intensity increases to a flat maximum and decreases as the source becomes very thick. The increase is greater, and the maximum flatter, for source materials of high atomic number as compared with those of lower atomic number. The increase is less when the counter window subtends a high solid angle and is almost absent when the sources are counted in a 2π counter. An equation is developed to combine the effects of self absorption in the source, back-scattering from the source material, back-scattering from the mounting material, and the change in angular distribution as the source observations. The angular scattering is a major effect which causes the counting rate from a thin source of high atomic number mounted on distrene to increase by about 5% for an increase in thickness corresponding to 1% of the absorption half thickness of the activity measured. A 2π counter is not sensitive to changes in angular distribution, and it is shown to be more precise than an end window type counter, for measuring the activity in thick sources. (auth)

4858

Ames Lab.

A BETA-RAY SPECTROMETER FOR COINCIDENCE MEASUREMENTS. R. T. Nichols, A. V. Pohm, J. H. Talbot, Jr., and E. N. Jensen. May 15, 1953. 37p. (ISC-345)

An intermediate-image β -ray spectrometer has been constructed utilizing the focusing properties of a U-shaped magnetic field distribution. The construction and performance of the instrument are discussed. A transmission of 10% has been attained with a resolution of about 6%. A scintillation spectrometer is used in conjunction with the intermediate-image spectrometer for the purpose of making coincidence measurements. (auth)

4859

Livermore Research Lab., Calif. Research and Development Co.

A SCINTILLATION SPECTROMETER FOR ROUTINE USE. G. D. O'Kelley. Dec. 4, 1952. 17p. (MTA-31)

An automatic γ -ray spectrometer for routine assays in radiochemical investigations has been constructed. A Ti -activated NaI crystal and a photomultiplier tube are used as the γ -ray detector. The detector pulses are amplified in a linear amplifier and fed to a simplified single-channel pulse analyzer. Circuits are described for the automatic control of the pulse analyzer bias and automatic recording of the counting data. Typical γ -ray spectra are shown as an indication of the performance obtained. (auth)

4860

Laboratory for Applied Biophysics, Mass. Inst. of Tech. PHOTOGRAPHIC EFFECTS OF COUNTER DISCHARGES. K. S. Lion and G. F. Vanderschmidt. May 1953. 67p. (NP-4644)

This report deals with a new system for the two-dimensional reception and intensification of a radiation pattern. The basic principle of the method is discussed briefly as follows: two electrodes forming a parallel-plane counter are connected to a voltage source. At least 1 electrode is transparent to the radiation to be recorded. A discharge-sensitive material, such as a photographic emulsion on an appropriate carrier or a fluorescent substance, is located between the electrodes. If radiation enters the counter, a discharge will be initiated which produces a

dot on the photographic emulsion or the fluorescent screen many times more intense than the dot which would have been produced by the initial radiation directly. A number of variations to the basic principles are presented. A method for calculating the total gain of the amplification process is given. A method for making the emulsion more sensitive is presented. The intensifier system described here offers an advantage over others in that it is sensitive to radiation only during the application of a voltage; its signal-to-background ratio should be higher, therefore, than the one of a system with an inherently high emulsion sensitivity. A number of advantages and disadvantages of the point and parallel-plane counters are presented with a discussion of characteristics of each. Influences of various apparatus on each is discussed. (J.A.G.)

4861

Atomic Energy Project, Univ. of Rochester
THE MEASUREMENT OF BREATH RADON BY CHARCOAL ADSORPTION. John B. Hursh. May 15, 1953. 25p. (UR-258)

A method of measuring breath radon by adsorption on charcoal cartridges is described. The charcoal is later heated and the radon driven off is measured. Tests performed with an artificial lung demonstrate satisfactory recoveries. A limited number of field measurements provided consistent results. The principal advantage of the method is believed to be the greater reproducibility which can be obtained in the sample-collection process. An estimation is made of the necessary time lapse between the worker's departure from the plant atmosphere and the taking of a breath sample. (auth)

4862

THE ABSOLUTE SCINTILLATION EFFICIENCY OF ANTHRACENE. J. B. Birks and M. E. Szendrei. *Phys. Rev.* **91**, 197-8(1953) July 1.

Various experimental observations which were used in determining the absolute scintillation efficiency of anthracene are listed. It was found that the fluorescence transmission spectrum and scintillation efficiency were independent of crystal thickness d , for $d > 1.5$ mm, and final measurements were obtained from the mean of those on 4 clear, polished crystals exceeding this thickness. An absolute scintillation efficiency of 0.324% for 5.3-Mev α particles was obtained. Hopkins (*Rev. Sci. Instr.* **22**, 29(1951)) found that the scintillation efficiency for 5.3-Mev electrons is 11.6 ± 0.2 times that for excitation by α particles of the same energy. Thus, the efficiency for 5.3-Mev electrons is $3.76 \pm 0.07\%$, which corresponds to a mean photon energy expenditure $E_{IF} = 70.5 \pm 3.8$ ev/fluorescence photon. The value of E_{IF} derived from "photon cascade" theory is 68 ev/photon. (L.M.T.)

4863

A MULTIPLE-COUNTER SYSTEM FOR ISOTOPE ENCEPHALOMETRY. Douglas A. Kohl. *Nucleonics* **11**, No. 7, 16-19(1953) July.

A multiple-detector positioner providing better reproducibility, better detection of bilaterally symmetrical activities, and greater sensitivity for brain-tumor location than is possible with a single-detector method is described. The positioner holds 18 Bi-cathode G-M tubes in concentric Pb shields. The shields are moved axially within close-fitting sleeves by means of separate hand-operated feed-screw mechanisms. The axes of the detectors intersect at a common central point and are arranged symmetrically. The 18 detectors are counted in 3 groups of 6, providing a total of 9 symmetric positions plus a recheck of 3 significant positions. The entire survey requires 25 min, including the data recording time. (L.T.W.)

4864

THE ROLE OF THE POLYATOMIC CONSTITUENT IN COUNTERS WITH AN EXTERNAL CATHODE. Daniel Blanc and Jean Uebbersfeld. *Compt. rend.* **236**, 2228-30(1953) June 8. (In French)

The threshold of external cathode counters filled with pure methylal under a pressure of the order of 7 cm of Hg undergoes, after filling, a progressive lowering. The phenomena obtained after heating to approximately 200°C and cooling to room temperature are identified. These are in accord with the existence of a deposit of the polyatomic constituent on the internal wall of the glass. (tr-auth)

4865

COMBINATION PEAKS: AN ENERGY ADDITION EFFECT IN SCINTILLATION COUNTERS. P. S. Jastram. J. A. Whalen, and O. H. Zinke. *Rev. Sci. Instr.* **23**, 648-9(1952) Nov.

Interpretation of the pulse-height distribution in the energy spectrum of a nuclear disintegration detected by a scintillation counter is subject to the error of simultaneous scintillations arising from two incident radiations, such as cascaded γ 's, causing a spuriously high peak. True peaks may be distinguished from combination peaks by their different dependence on either solid angle or absorbing material. The counting rate due to a single radiation is proportional to the solid angle subtended by the counter at the source; that associated with two quanta varies as the square of the solid angle. The telltale variation in combination-peak height, with change in solid angle, is shown for the γ spectrum of Na^{22} . Combination peaks can also be recognized by use of absorbing material placed between the source and the counter. (L.T.W.)

4866

COUNTING RATE MEASUREMENT BY INTERVAL SAMPLING. M. F. Crouch and G. E. Haynam. *Can. J. Phys.* **31**, 356-65(1953) April.

Two methods are described for measuring high counting rates with a counting device having a long resolving time. Both methods are based on the deliberate introduction of a large but calculable counting loss to transform a high counting rate to a lower rate. Formulas giving the counting rate in terms of the reduced rate are presented, together with formulas for the standard deviation of the counting rate. The performance of circuits used to study one of the methods is described, and a comparison is made with conventional rate measurement methods. It is found that, while the relative simplicity of equipment is gained at the expense of speed of measurement, the latter sacrifice is not as severe as might be expected. (auth)

4867

EXPERIMENTAL METHOD FOR DETERMINATION OF COUNTING GEOMETRY. Ben Kalmon. *Nucleonics* **11**, No. 7, 56-9(1953) July.

An experimental method is described for the determination of counting geometry which does not require the use of a point source. A thin, uniform source is realized by soaking filter paper in a radioactive solution. Disks of varying radii are made from the soaked filter paper. The counting rate is determined when each of these is placed at a given distance from the counter. If the counting rate per unit area is plotted against the area of the disk, the value corresponding to a point source located on the axis of the system can be extrapolated. By comparing this value with that of an extended source of the same strength per unit area, the geometry of the extended source can be obtained in terms of that of a point source. The experimental procedure is described, and results obtained are presented. (C.H.)

4868

DOSIMETRY OF A KILOCURIE COBALT-60 SOURCE. Sol

Davison, Samuel A. Goldblith, Bernard E. Proctor, Marcus Karel, Billy Kan, and Charles J. Bates. Nucleonics **11**, No. 7, 22-6(1953) July.

Three chemical dosimeters (ferrous-ferric, ceric-cerous, methylene blue) and one physical dosimeter (adiabatic calorimeter) were studied to determine the energies absorbed by γ -irradiated samples. The yields for the ferrous-ferric and ceric-cerous dosimeters were ~ 20 and 3.3 micromole/liter/1000 rep, respectively. The D_0 value of the methylene blue was 2.60×10^5 rep. (L.T.W.)

4869

THE ROENTGEN: DEFICIENCIES IN PRESENT-DAY FREE-AIR CHAMBER STANDARDS. L. A. W. Kemp. Nature **172**, 35(1953) July 4.

Critical consideration of the geometry of the air-free chamber x-ray standard in present use at the National Physics Laboratory, Teddington, England, and that in use at the U. S. Bureau of Standards, led to the conclusion that serious deficiencies exist in these standards. A series of pressure-change experiments and observations made by direct comparison are reported on which the conclusions are based. (C.H.)

4870

ABSOLUTE NEUTRON FLUX FROM A Ra + Be SOURCE. N. K. Saha and L. Kasturi Rangan. Indian J. Phys. **27**, 18-24(1953) Jan.

The absolute flux of neutrons from a (Ra + Be) source has been determined by the method of "thermalization" (Barschall et. al., Revs. Mod. Phys. **24**, 1(1952)). A large volume of $MnSO_4$ solution is activated by thermalized neutrons from the Ra + Be source held at the center and the solution activity measured by a specially constructed immersion β -ray counter. The activity of Mn^{56} with reference to the neutron beam is calibrated with the help of an end-window β -ray counter designed for the purpose. Detailed corrections for backscattering and self-absorption of the β rays, geometry and efficiency of the end-window counter, finite size of the source, etc. have been applied. The absolute flux has been determined to be $F_0 = 13.2 \times 10^6$ neutrons/g/sec with a probable error of $\pm 25\%$. Values of F_0 determined by other workers for a similar source have been compiled for comparison. The approximate value supplied by the manufacturer of the neutron source is 1.3×10^6 neutrons/sec for a 100 mg (Ra + Be) source of this type, and it agrees well with the present determination. (auth)

4871

γ - γ ANGULAR CORRELATION MEASUREMENTS. Santimay Chatterjee and Ajit Kumar Saha. Phys. Rev. **91**, 200-1(1953) July 1.

A mathematical discussion is presented of the effects of the following factors on angular-correlation measurements: (1) duration of measurements, (2) angular resolution, and (3) scattering when the phosphors are not shielded. (L.M.T.)

4872

CONTRIBUTIONS TO THE STATISTICAL THEORY OF COUNTER DATA. G. E. Albert and Lewis Nelson. Ann. Math. Statistics **24**, 9-22(1953) March.

A new mathematical model is proposed for the action of counters such as the G-M or the scintillation counters. It is assumed that after each registration the counter is inoperative for a time interval of random length. The distribution of lengths of the inoperative periods is so defined that the Type I and Type II models familiar in the literature on counters are special cases. More important, it also allows an action that is a compromise between those two types. Assuming that the sequence being counted is a Poisson process with mean rate of occurrence mT , $m > 0$, in an arbitrary interval of length T , the process generated by the counter is discussed and rules are established for obtaining

confidence intervals for the parameter m from various types of counting experiments. (auth)

MESONS

4873

Radiation Lab., Univ. of Calif., Berkeley
THE PRODUCTION OF MESONS BY PHOTONS AT 0° (rev. thesis). Nelson Jarmie. Mar. 1953. 37p. (UCRL-2159)

H_2 gas was bombarded in a high-pressure, low-temperature target by the 322-Mev bremsstrahlung of the Berkeley synchrotron to produce π^+ mesons at $0 \pm 4^\circ$ to the beam. The mesons were bent out of the photon beam by a magnetic field, passed through a Pb channel and Pb absorbers, and detected in Ilford C-2 emulsions. Data were obtained for a photon energy of 278 ± 4 Mev. (This is for a meson energy of 134 ± 4 Mev.) The absolute differential cross section is:

$$\frac{d\sigma}{d\Omega}(k, \theta) = \left(6.2 \begin{smallmatrix} +2.6 \\ -1.9 \end{smallmatrix} \right) \times 10^{-30} \text{ cm}^2/\text{ster./proton/quanta.}$$

This point was combined with other data at other angles to give an angular distribution of the form $a + b\cos\theta + c\sin^2\theta$, and this is compared with the phenomenological isobar theory. The cross section was corrected for nuclear absorption in the gas and meson absorber, scattering, and decay in flight, and was transformed to the c.m. system. It must be noted that this cross section was calculated from 10 events. A study of the calibration of the beam was made, and a discussion of the theory of errors of a small number of events is included. Mesons from D were also detected, and the ratio of the production from D to H is given but is not statistically significant. The significance of the experimental results in the light of the phenomenological theory as developed by Watson and Brueckner and by Feld is discussed. (auth)

4874

PRODUCTION AND SCATTERING OF MESONS. J. C. Gunn. Advances in Phys. **2**, 213-64(1953) Apr.

A review is presented of recent experiments on the production and scattering of π mesons. The results are then analyzed to determine if the character of the π mesons and their coupling to nucleons can be reasonably deduced, and whether a satisfactory agreement is then found between experimental and theoretical results. The author concludes that the experimental contributions to the study of meson production and scattering have been more striking than the theoretical ones, and future experimental work to fill the present gaps and correct the erroneous results is suggested. 97 references. (L.M.T.)

4875

ON SOME PROPERTIES OF THE INTERACTIONS BETWEEN ELEMENTARY PARTICLES. Sadao Ôneda. Progr. Theoret. Phys. (Japan) **9**, 327-44(1953) Apr.

To secure sufficient stability of matter, the "Law of Conservation of Heavy Particles" is postulated. From this postulate, a sort of intrinsic charge called nucleonic charge is assigned to every elementary particle uniquely. In analogy to electric charge, the law can be stated as "The Conservation Law of Nucleonic Charge" and the properties of this charge are investigated. By means of this charge and recently obtained knowledge about heavy mesons, the possible existence of families of elementary particles is presented. Discussions about the interactions between families which seem to have primary importance are made. Bearing the "Conservation Law of Nucleonic Charge" in mind, the production mechanism of heavy mesons is analyzed, and the necessity of the ordering of the interactions between families is stressed. Some speculations about heavy mesons and the threshold energies for productions are discussed. (auth)

4876

THE PRODUCTION OF MESONS IN THE NUCLEON-NUCLEON COLLISIONS AT EXTREMELY HIGH ENERGIES. Tchang-Fong Hoang. *J. phys. radium* **14**, 395-406(1953) June. (In French)

A kinematic method, based on the Lorentz transformation, has been used to analyze the showers of cosmic rays. It allows the estimation of the primary energy and the reconstruction of the angular distribution in the c.m. system. The method has been applied to the study of showers attributed to a single nucleon-nucleon collision. The results show that the multiplicities are grouped into 2 distinct families, one conforming to the Heisenberg theory and the other to the Fermi theory. The angular distribution of mesons in the c.m. system has been found to be quasi-isotropic in the majority of cases studied. The ratio of neutral mesons to charged mesons is approximately $\frac{1}{2}$. (tr-auth)

4877

THE CLASSICAL SCATTERING OF NEUTRAL MESONS. Clarence R. Mehl and Peter Havas. *Phys. Rev.* **91**, 393-7(1953) July 15.

In a recent paper a theory of point particles interacting through neutral meson fields was developed from the point of view of action at a distance. Equations of motion differing from those of field theory were obtained. These equations are now used to calculate the scattering of scalar and vector mesons by nucleons. The resulting cross sections are somewhat larger than those previously obtained from field theory, but the difference is so small that an experimental distinction hardly appears possible. (auth)

4878

THE PRODUCTION OF MESONS ABOVE 10 Bev. C. B. A. McCusker, N. A. Porter, and B. G. Wilson. *Phys. Rev.* **91**, 384-7(1953) July 15.

12,000 local penetrating showers from C and paraffin have been compared, using a 31-channel hodoscope in order to study nucleon-H collisions above 10 bev. The average multiplicity of penetrating charged particles from the detected showers from C is found to 4.42 ± 0.20 and the multiplicity from H considerably less. An upper limit of 2.4 is given. It is concluded that the multiple production of mesons is infrequent at this energy. (auth)

MICROWAVES

4879

Columbia Radiation Lab., Columbia Univ.
[MICROWAVE RESEARCH;] FIRST QUARTERLY PROGRESS REPORT. Mar. 31, 1953. 32p. (NP-4631; CU-1-53-SC-42519-Phys.)

Construction and performance of 2.5-, 6-, and 10.6-mm magnetrons are discussed. The effect of varying parameters on low-field magnetron operation, including mm wavelength tubes is given. A TE₀₁ absorption-type mm wavemeter is described. Microwave investigations of the hfs of hydrogen and fine structure of singly ionized helium are reported. Five nuclear quadrupole resonant lines in the spectrum of Sb₂S₃ are identified. New techniques in the very-high-temperature microwave spectroscopy of HgFCl, CsF, and CsCl are presented. Design of a high-sensitivity Stark spectrometer is described. A new value for the constant a in the molecular hamiltonian has been determined for CH₃Cl³⁵, CH₃Cl³⁷, and S³³. The molecular spectra of OCS, HCN, and DCN were analyzed by a high resolution spectrometer. Resolution of the quadrupole splitting of the $J = 0 \rightarrow 1$ transition of HC¹²N and observation of the $K = 3$ lines in the free radical O¹⁶H¹ was achieved. Frequencies for the $v = 0$ and 1 state of the $J = 0 \rightarrow 1$ transition of CsCl were determined by the molecular beam electric resonance method.

It was found that the A and B fields in this apparatus could be replaced by single wires. (For preceding period see NP-4542.) (K.S.)

MOLECULAR PROPERTIES

4880

RELATIONS BETWEEN MOMENTS OF INERTIA AND ROTATION FREQUENCIES OF ISOTOPIC MOLECULES. L. M. Sverdlov. Translated from *Doklady Akad. Nauk S.S.S.R.* **88**, 249(1953). 4p. (NSF-tr-12; D-88-249)

Relationships are derived for the identification of isotopic molecules by their mass-dependent properties. Rules of sums for moments of inertia, rotational constants, and rotational frequencies are given. (K.S.)

4881

STUDY OF THE SPIN-SPIN COUPLING IN THE QUADRUPOLE RESONANCE OF NITROGEN. Yves Ayant. *Compt. rend.* **236**, 2232-4(1953) June 8. (In French)

The calculation of the second moment of the resonance ray of the H bound to N in hexamethylenetetramine gives a ray with width of 3.2 kc. The experimental value is much lower. Therefore, it is necessary to secularize the N-H coupling relative to the H-H coupling. Analysis of the calculations shows that the protons farthest from the N are responsible for the width of the ray. The calculated results are in excellent agreement with experimental results. The value of the second moment of cyanogen iodide is also calculated. It is concluded that approximately 10% of the width of a ray is caused by the Zeeman effect of various magnetic fields. (J.S.R.)

NUCLEAR PROPERTIES

4882

MESONIC INTERPRETATION OF NUCLEAR PROPERTIES. R. G. Moorhouse. *Advances in Phys.* **2**, 185-212(1953) Apr.

While π -meson field theory is qualitatively successful in an elementary way in the explanation of nuclear forces, it is not successful in the quantitative explanation of the forces or other nuclear properties such as magnetic moments of protons and neutrons. This failure to achieve quantitative agreement is thought to be due to the mathematical methods used, and a main effort in π -meson field theories is directed toward improvement of these methods. This article reviews recent efforts along this line and their degree of success. Specific discussions are presented of the use of the meson field theory in calculating: (1) electromagnetic properties of single nucleons, (2) forces between two nucleons, and (3) many-body forces which, in practice, involve heavy nuclei. 73 references. (L.M.T.)

4883

Brookhaven National Lab.
THE HALF-LIFE OF THALLIUM-204. Garman Harbottle. [1953] 4p. (BNL-1441)

A determination of the half life of Tl²⁰⁴ has given the value 4.0 ± 0.1 yr. (auth)

4884

Brookhaven National Lab.
FAST NEUTRON CROSS SECTIONS AND NUCLEAR LEVEL DENSITY. D. J. Hughes, R. C. Garth, and J. S. Levin. [1953] 26p. (BNL-1481)

The capture cross sections for unmoderated fission neutrons, effective energy one Mev, are determined by the average properties of nuclear levels at excitation energies equal to neutron binding plus one Mev. The level spacings determined from measured cross sections for 61 isotopes are discussed in connection with the statistical and shell nuclear models. Whereas the discontinuity in neutron binding energy at magic numbers accounts for most of the abnor-

malities of the cross sections of the neutron-magic nuclei, the effect of shell structure is evident in level spacing even at high (5 to 7 Mev) excitation energy. The level spacings obtained for non-magic nuclei, on the other hand, are in reasonable agreement with the statistical nuclear model, and in addition are the same for levels of widely different spin. (auth)

4885

CERTAIN REGULARITIES IN NUCLEAR SPIN AND A NUCLEAR SHELL MODEL. I. A. Vaisman. Translated from *Doklady Akad. Nauk S.S.S.R.* 88, 237-40(1953). 8p. (NSF-tr-16; D-88-237)

A brief abstract of this material appears in *Nuclear Science Abstracts* as NSA 7-3193.

4886

Radiation Lab., Univ. of Calif., Berkeley
SCATTERING OF 190-MEV DEUTERONS ON PROTONS.
Arnold L. Bloom and Owen Chamberlain. June 4, 1953.
26p. (UCRL-2237)

A measurement of the total d-p scattering cross section is reported. Because of the divergence of coulomb scattering at small angles a small-angle cut-off has been applied to the elastic scattering. The result may be stated as follows: The cross section for elastic scattering to angles greater than 10° in the c.m. system, plus the total inelastic-scattering cross section is $94^{+7}_{-1} \times 10^{-27}$ cm². Measurements are also reported of those inelastic-scattering processes in which both protons suffer significant momentum changes. We have termed these events "inelastic p-p type collisions." The differential cross sections for these events appear to be smaller than would be expected in view of the theoretical considerations of others. (auth)

4887

NUCLEAR QUADRUPOLE RESONANCE IN RHOMBIC SULFUR AND THE QUADRUPOLE MOMENTS OF S³³ AND S³⁵.
H. G. Dehmelt. *Phys. Rev.* 91, 313-4(1953). July 15.

Four closely spaced absorption lines due to nuclear quadrupole resonance of the S³³ isotope have been observed near 22.9 Mc in a sample of rhombic sulfur containing this isotope in its natural abundance of 0.74%. As the nuclear spin of S³³ is $\frac{3}{2}$, these lines correspond to the transition $m = \pm\frac{1}{2} \leftrightarrow m = \pm\frac{3}{2}$ and an average quadrupole coupling constant $eQ^3q_{zz}/h = 45.8$ Mc. The bond structure of the S₈ molecule is discussed with respect to the evaluation of q_{zz} , the gradient of the electric field at the site of the nucleus. From the measured coupling constant eQ^3q_{zz} and the calculated q_{zz} , the value $Q^3 = -0.050 \times 10^{-24}$ cm² is obtained for the nuclear quadrupole moment of S³³. With the ratio Q^{35}/Q^{33} known from microwave data, this leads to $Q^{35} = +0.035 \times 10^{-24}$ cm² for S³⁵. (auth)

4888

THE SPIN OF CERTAIN ODD-ODD NUCLEI I. GENERAL FORMULAE. Claude Marty, Roger Nataf, and Jacques Prentki. *Compt. rend.* 236, 2387-9(1953) June 22. (In French)

According to the shell model the nuclei contain a neutron and a proton outside of the saturated levels. The interaction between the 2 nucleons, which is assumed to be central, separates different levels of energy according to the value of the resultant angular momentum. One has thus the spin of the fundamental level and of the first excited level for the odd-odd nuclei. (tr-auth)

4889

MEASUREMENT OF THE NUCLEAR RADIUS OF SOME ELEMENTS. M. Ageno, G. Cortellessa, R. Querzoli. *Rend. ist. super. sanita* 16, 21-7(1953). (In Italian) (cf. NSA 7-317)

By the use of a method described in a previous work, the total cross section for 14-Mev neutrons of Al, O, P, S, Cu,

Au, Hg, Pb, and Bi is determined under good geometric conditions and the effective nuclear radii are then deduced from this. No systematic deviation from the known laws of linear dependence of nuclear radii on the cube root of the mass number was noted, and so the authors conclude that, within the limits of accuracy of the measurements (2%), Feshbach and Weisskopf's statistical theory is in accord with the experimental results. (auth)

4890

ON THE PROTON-NEUTRON INTERACTION. Toshiya Komoda and Muneeo Sasaki. *Progr. Theoret. Phys. (Japan)* 9, 468(1953) Apr.

In the phenomenological treatments of nuclear force, non-singular or Yukawa potentials have generally been used for the sake of simplicity. These potentials will be sufficient so long as the energy of a system is low. However, to secure better fit with experiments up to high energies, it seems necessary that investigations be extended to the various types of potentials, singular as well as non-singular. This note presents results of computations of the deuteron magnetic and quadrupole moments using the potential with r^{-2} singularity. It was found that the results did not contradict the known facts concerning the deuteron ground state. (auth)

4891

A SURVEY OF NEUTRON AND PROTON BINDING ENERGIES. N. Feather. *Advances in Phys.* 2, 141-84(1953) Apr.

Limiting values of last-nucleon binding energies are available from measured reaction energies of induced transformations satisfying the selection rule $\Delta A = 0, \pm 1$ (A = mass number) in about 140 cases. In 14 cases upper and lower limiting values are known separately, and these agree in each case within the limits of experimental error. Taking the other 126 values as 'true' (rather than limiting) values, and using information concerning total energies of β disintegration, the number of last-nucleon binding energies which are reasonably well determined is increased to more than 600. These values are tabulated, and discussed in relation to the v. Weizsäcker mass formula. Apart from certain anomalies which are treated individually, the discussion brings out the effect of α -unit structure in light nuclei, diminishing in importance to become almost negligible beyond $A = 40$, and yields mean values for nucleon-parity dependent terms in the range $A \sim 215$. The recovery of 'normal' last-nucleon binding energy after completion of a closed shell is followed in detail over the range $126 \leq N \leq 136$ (N = neutron number) and somewhat less closely over the range $82 \leq Z \leq 92$ (Z = proton number). (auth)

4892

EFFECT OF ELECTRIC QUADRUPOLE INTERACTION ON THE γ - γ DIRECTIONAL CORRELATION IN Cd¹¹¹. II. H. Albers-Schönberg, E. Heer, T. B. Novey, and R. Rütschi. *Phys. Rev.* 91, 199-200(1953) July 1.

The authors in a previous letter (*Phys. Rev.* 90, 322(1953)) described experiments with metallic crystals of In¹¹¹ which indicated that the interaction which influences the angular correlation in this type of source is electric. Further assumption is made here that the attenuations in polycrystalline sources are due to the coupling between the electric quadrupole moment of the nucleus and the inhomogeneous electric crystalline field. The authors support this assumption with a discussion of results of angular correlation experiments of other investigators using cubic crystals and solutions, and of their own recent experiment with a melt of In metal enriched in In¹¹¹. It is concluded that the reduced anisotropy in the case of Cd¹¹¹ can be largely, and perhaps entirely, explained by the quadrupole interaction hypothesis. (L.M.T.)

4893

HYPERFINE STRUCTURE OF THE METASTABLE TRIPLET STATE HELIUM-3. Gabriel Weinreich, Gerard M. Groszof, and Vernon W. Hughes. *Phys. Rev.* **91**, 195-6 (1953) July 1.

Measurements were made of the hfs of the 3S_1 metastable state of He^3 , using the atomic-beam magnetic-resonance method similar to that used to determine the magnetic moment of He^4 (Hughes et al., *Phys. Rev.* **82**, 322(1951); **86**, 618(1952)). Transitions $(F, m_F) = (\frac{3}{2}, -\frac{1}{2}) \rightarrow (\frac{1}{2}, \frac{1}{2})$ and $(\frac{3}{2}, -\frac{3}{2}) \rightarrow (\frac{1}{2}, -\frac{1}{2})$ were observed at fields of $\sim \frac{2}{3}$ gauss. The final result for the hyperfine splitting of the state was 6739.71 ± 0.05 Mc. (L.M.T.)

4894

EFFECT OF NUCLEAR STRUCTURE ON THE HYPERFINE STRUCTURE OF He^3 . Vernon Hughes and Gabriel Weinreich. *Phys. Rev.* **91**, 196-7(1953) July 1.

The measurement of the hfs of the He^3 atom in its metastable 3S_1 state (see preceding abstract) was accurate enough to reveal effects due to the internal structure of the He^3 nucleus. An estimate of this influence is presented in this note, under the same assumptions as were made by Bohr for the hfs of D (*Phys. Rev.* **73**, 1109(1948)). (L.M.T.)

4895

THE HALF-LIFE OF Co^{60} . J. Kastner and G. N. Whyte. *Phys. Rev.* **91**, 332(1953) July 15.

A new determination of the half life of Co^{60} yields the value of 5.21 ± 0.04 years. (auth)

4896

PREFERRED RATIOS OF ENERGIES OF EXCITED STATES OF NUCLEI. Martin G. Redlich. *Phys. Rev.* **91**, 328-32 (1953) July 15.

For the lowest three states in the decay schemes of 28 nuclei, the ratio of the larger to the smaller of the intervals between adjacent states is known within ± 0.018 . Twenty ratios are given by fractions with integral denominators 1 to 5 approximately, within experimental uncertainty. Integral relations exist in the decay schemes of nuclei with two or three level pairs. Energies of the several known lines of seven nuclei are approximately integral multiples of a single energy, different for each nucleus. (auth)

NUCLEAR REACTORS

4897

Atomic Energy Research Establishment, Harwell, Berks (England)

BORON-CADMIUM INTERCALIBRATION FOR PILE NEUTRONS IN GLEEP. F. C. W. Colmer, E. R. Wiblin, and W. B. Woollen. Mar. 19, 1953. 12p. (AERE-N/R-1159)

A convenient practical way to calibrate the Gleep graphite swinging train for the effect of varying cross section in the samples, is to load the graphite in the train with small lengths of Cd wire, and measure the change in k of the pile due to the extra absorption. Most of the contaminants in graphite, however, obey a $1/v$ law of absorption, whereas Cd is essentially black to all thermal neutrons. Experiments outlined were done to determine the relative changes in k produced by a $1/v$ absorber and Cd. The mean velocity of thermal neutrons in GLEEP is estimated, and a comparison is made between changes in k measured by relaxation times and those measured by insertion of absorbers into the pile. (Revised version of AERE-N/M-14) (auth)

4898

Atomic Energy Research Establishment, Harwell, Berks (England)

CRITICAL SIZE OF A SYSTEM INCLUDING A HYDROGENOUS REFLECTOR. J. P. Elliott. Apr. 1953. 12p. (AERE-T/R-1174)

The method of Davison (AERE-T/R-826) for finding the

critical size of a homogeneous system containing hydrogenous material is modified to the problem in which there is a hydrogenous reflector. Such modification is necessitated by the presence of a large number of slow neutrons in the reflector in the absence of any appreciable $1/v$ absorption. (auth)

4899

Brookhaven National Lab.

SOME GENERAL PROBLEMS IN OPERATING A RESEARCH REACTOR. Robert W. Powell. [1953] 23p. (BNL-1474)

The problems involved in the operation of a large-scale reactor are classified into three main categories: technical, maintenance, and personnel. Reactivity control, poisoning, induced reactivity, heat production, and materials packaging, are the technical problems outlined. The radiation hazards and economics of pile maintenance are emphasized. Personnel problems are confined largely to organization and training. (K.S.)

4900

Joint Establishment for Nuclear Energy Research (Norway) DETERMINATION OF THE NEUTRON SPECTRUM BY MEANS OF BORON ABSORPTION. Bertel Grimeland. 1953. 16p. (JENER-16)

By passing neutrons in one of the JEEP fast channels through different thicknesses of B, the neutron density was measured as a function of B thickness, and from this it was possible to determine the neutron spectra. (J.E.D.)

4901

Joint Establishment for Nuclear Energy Research (Norway) Xe^{135} POISONING OF THE JEEP. V. O. Eriksen and W. Hålg. 1953. 22p. (JENER-17)

The first part of this paper contains some general considerations of the effect of an absorber on the reactivity of a reactor. The results are applied to the JEEP, and the theory is compared with experiments on the reactivity-change connected with the growth and the decay of Xe^{135} . The reactor has been operated at different neutron fluxes corresponding to 100, 175, and 250 kw. At the 250-kw power level the observed reactivity change in equilibrium is 185×10^{-5} , in good agreement with the calculated value 198×10^{-5} . (auth)

4902

NEUTRON DATA NEEDED FOR SHIELDING AND REACTOR DESIGN. Herbert Goldstein. *Nucleonics* **11**, No. 7, 39-43 (1953) July.

Data of interest for shielding purposes include inelastic neutron scattering, total cross sections, angular distributions, γ spectra, and fast-neutron reactions. Data of interest for reactor design include inelastic scattering, angular distributions, and reaction cross sections. Each of these properties is briefly discussed. (L.T.W.)

NUCLEAR TRANSFORMATION

4903

Ames Lab.

ANGULAR AND ENERGY DISTRIBUTIONS OF PHOTO-PROTONS FROM ALUMINUM AND TANTALUM. M. M. Hoffman and A. G. W. Cameron. [Mar. 30, 1953] 35p. (AECU-2589)

Foils of Al and Ta were irradiated at energies from 25 to 65 Mev in the x-ray beam of the Iowa State College synchrotron. Photoprotons produced at various angles were recorded in nuclear emulsions. Those emitted with low energies appear isotropically distributed and have energy distributions characteristic of statistical evaporation processes. The higher-energy protons from Al have an angular distribution of the form $(\sin\theta + p\sin\theta\cos\theta)^2$ with $p \approx 0.7$, whereas those from Ta have a nearly pure $\sin^2\theta$

distribution. Their energy distributions can be represented in the form E_p^{-n} , where E_p is the proton energy. For Al sharp increases in the exponent n occur at a value of E_p slightly greater than half the maximum photon energy of the irradiation. The increases are considerably less in the case of Ta. The Al results are qualitatively consistent with Levinger's quasi-deuteron model of the nucleus. None of the proposed photon-interaction models gives a good explanation of the Ta results. (auth)

4904

Atomic Energy Research Establishment, Harwell, Berks (England)

THE PRODUCTION OF PHOSPHORUS 32 FROM PILE-IRRADIATED SULPHUR. W. J. Arrol and F. Hudswell, comps. and eds. Oct. 1952. 21p. (AERE-I/R-1033)

This collection of reports traces the development of the production of P^{32} from pile-irradiated S at A.E.R.E., Harwell, by a simple process of extraction and purification. The product is in the form of orthophosphate at high specific activity. The principles of the processes are stated. The development and construction of a rocking autoclave for the extraction is described with the aid of diagrams. The all-glass purification apparatus which is designed to treat the phosphate extract is operated entirely behind perspex shielding. The method of operation is described in full detail; it has been found necessary to introduce a step for the elimination of As. The routine inspection of the product for purity and activity is discussed. The possible weekly rate of production by one operator is 7 kg of S, i.e., about 7 to 8 c of P^{32} at the present pile flux. (auth)

4905

Brookhaven National Lab.

NEUTRON AND MESON STARS INDUCED IN THE LIGHT ELEMENTS OF THE EMULSION. M. Blau, A. R. Oliver, and J. E. Smith. [1952] 38p. (BNL-1435)

Laminated emulsions have been exposed to the neutron and positive meson beam at the Nevis Cyclotron. In the case of the neutron exposure (300 Mev) it has been found that $21 \pm 3\%$ of the emulsion stars originate in light nuclei. The number of fast protons and their angular distribution is similar in stars from light and heavy elements. The black tracks in light element stars show a marked forward excess. The energy range of the mesons incident on the laminated emulsions was from 50 to 80 Mev. Of the emulsion stars, 24 to 30% originate in light nuclei. In about 15 to 20% of these cases, the scattered meson emerges from the nucleus. Charge exchange scattering, if present at all, amounts to less than 10% of all interactions. More than 70% of the interactions (stars) result in absorption of the incident meson. The absorption occurs chiefly in nucleon pairs. (auth)

4906

Brookhaven National Lab.

SUCCESSIVE NEUTRON CAPTURE IN Ta. J. W. Mihelich. [1952] 3p. (BNL-1437)

A thin Ta film (Ta^{181}) was irradiated in the Brookhaven reactor for 7 days and the conversion-electron spectrum recorded in 180° spectrographs. The spectra showed a converted γ ray of 246 kev in W to decay with a half life of ~ 6 days, presumably that of Ta^{183} . By photometering a spectrogram exposed for 6 days, the ratio of the intensities of the Ta^{182} 100-kev L electron lines and the Ta^{183} 246-kev K line was determined as 12. From this, and by using appropriate K/L, L/M, etc., ratios, the thermal-neutron capture cross section of Ta^{182} was found to be $\geq 180,000$ b. (L.M.T.)

4907

Nuclear Development Associates, Inc.

TABLES OF PENETRABILITIES FOR CHARGED PARTI-

CLE REACTION. Herman Feshbach, M. M. Shapiro, and V. F. Weisskopf. June 15, 1953. 117p. (NYO-3077; NDA-15B-5)

A method for calculating transmission coefficients of charged particles in nuclear reactions is discussed, and the results are presented in tabular form. These data, along with the corresponding neutron-transmission coefficients presented in NYO-636, make it possible to make predictions on several important reactions. (L.M.T.)

4908

NUCLEON ISOBARS AS INTERMEDIATE STATES IN BETA-DECAY. Ya. B. Zeldovich. Translated from *Doklady Akad. Nauk S.S.S.R.* 89, 33(1953). 5p. (NSF-tr-14; D-89-33)

Consideration of the β -decay process of the neutron leads to a proposal for two intermediate nucleon isobars of L and K 0 spin. The decay schemes are $L \rightarrow p + e^-$ and $K \rightarrow p + \bar{\nu}$. It is shown that such intermediate reactions eliminate some difficulties in the meson scheme for β decay, and that required selection rules can be obtained by an independence of these particles from the neutron and antineutrino spins. Initial assumptions provide for the symmetry of e^+ and e^- emission, allowing theory to fit the form of known spectra. (K.S.)

4909

DETERMINATION OF THE CROSS SECTION FOR THE PRODUCTION OF PROTONS BY THE DEUTERON BOMBARDMENT OF He^3 AS A FUNCTION OF PROTON ANGLE AND DEUTERON ENERGY. John Leonard Yarnell. Ph.D. Thesis, Minnesota Univ., 1953.

A thin gaseous target of He^3 was bombarded by mono-energetic deuterons to produce protons which were detected in a NaI scintillation counter. Observations were made between the angles of 15 and 135° at deuteron energies of 0.260, 0.455, 0.978, 1.51, 2.01, 2.50, 3.01, and 3.56 Mev. The reaction cross section appears to be isotropic in the c.m. system at deuteron energies of 0.260 and 0.455 Mev. At 0.978 Mev, the cross section at 120° is $\sim 10\%$ smaller than it is at 20° . Above 0.978 Mev the angular dependence of the cross section becomes more pronounced, the cross section becoming smaller at higher proton angles as the energy is increased. The total cross section is observed to pass through a maximum at 0.43 ± 0.030 Mev, the value at this maximum being 0.9 ± 0.1 b. (auth)

4910

NEUTRON CAPTURE GAMMA-RAYS IN CADMIUM, COBALT, AND CHLORINE. William A. Reardon, Ralph W. Krone, and Robert Stump. *Phys. Rev.* 91, 334-7(1953) July 15.

A two-crystal scintillation spectrometer has been used to measure the γ spectra resulting from the thermal-neutron capture in Cd^{113} , Co^{59} , and Cl^{35} . Measurements extended over the range of energies from 0.6 to 4.0 Mev. Several prominent γ rays were observed. Intensity considerations suggest that cascades involving several of these low-energy γ rays play a dominant part in the decay schemes. (auth)

4911

EXPERIMENTAL STUDY AND THE MECHANISM OF THE REACTION $B^{10}(d,\alpha)2\alpha$. Pierre Cüer and Jean-Jacques Jung. *Compt. rend.* 236, 2401-3(1953) June 22. (In French)

The reaction $B^{10}(d,\alpha)2\alpha$ has been studied with the deuteron energy equal to 1 Mev. The classic mechanisms of the reaction $B^{10}(d,\alpha)Be^8$, (Be^8), $Be^8 \rightarrow 2\alpha$ yield a complete account of the results. Two experimental arrangements have allowed the observation in the reaction of the excited states of 5 and 7.5 Mev, and with less certainty of 4.1 and 9.6 Mev. The possibility of the intermediate reaction $B^{10}(d,3\alpha)$ is quite low. (tr-auth)

PARTICLE ACCELERATORS

4912

Brookhaven National Lab.

THE COSMOTRON: A REVIEW. M. Hildred Blewett. [1953] 51p. (BNL-1445)

A description of the Brookhaven cosmotron is followed by a résumé, component by component, of its design. The necessary dovetailing in the construction is outlined in a chronology of the fabrication, assembly, and testing of the units. A summary of the preliminary operation of the accelerator includes injection and acceleration tests. In an appendix, figures on personnel are included with a table of the basic parameters of the cosmotron. (auth)

4913

Brookhaven National Lab.

[COSMOTRON] MAGNET. PART 1. DESIGN. J. P. Blewett, M. H. Blewett, G. K. Green, W. H. Moore, and L. W. Smith. [1953] 27p. (BNL-1446)

The magnet is designed to provide magnetic fields up to 14,000 gauss over a region roughly 9 by 30 inches surrounding the proton orbit of 30-ft radius. The magnet is C-shaped with the magnetic return inside the proton orbit. The magnet gap contour is shaped very precisely to accommodate and control the excursions of the proton beam from its stable orbit. The magnet is energized by current supplied to its water-cooled coil from a 26,000-kva motor-flywheel-generator set. Magnet parameters are tabulated, and the considerations which led to their choice are discussed. (auth)

4914

Brookhaven National Lab.

[COSMOTRON] MAGNET. PART 2. MAGNETIC MEASUREMENTS. G. K. Green, R. R. Kassner, W. H. Moore, and L. W. Smith [1953] 54p. (BNL-1447)

Techniques have been developed for the precise measurement of magnetic field shapes of both steady-state and time-varying fields. A series of measurements was used to refine the design of the magnet and to examine the effects, on field shape, of many parts of component equipment. Measurements of the fields of the magnet have been made in detail; they indicate a field shape that conforms to the design requirements. Measurements on the magnet shows good agreement with model predictions. (auth)

4915

Brookhaven National Lab.

[COSMOTRON] MAGNET. PART 3. MECHANICAL DESIGN, FABRICATION, AND ERECTION. R. A. Meyer and W. H. Moore. [1953] 23p. (BNL-1448)

The mechanical details of the structure of the magnet and its supports are outlined. Details are included of the manufacturing processes and the final assembly. (auth)

4916

Brookhaven National Lab.

[COSMOTRON] MAGNET. PART 4. TESTING PROGRAM FOR THE INDIVIDUAL BLOCKS OF THE MAGNET. M. H. Blewett, J. M. Kelly, and W. H. Moore. [1953] 18p. (BNL-1449)

The 288 blocks that constitute the magnet were tested, individually, to determine their magnetic characteristics. These measurements were used to arrange the blocks in an order that would minimize azimuthal harmonics. The remanent field was the only magnetic parameter that showed appreciable deviations. (auth)

4917

Brookhaven National Lab.

[COSMOTRON] MAGNET. PART 5. COIL. J. A. Kosh and M. Livingston. [1953] 19p. (BNL-1450)

The exciting winding of the magnet contains 48 turns that carry a peak current of 7000 amp. The design, particularly

of the special construction required at the ends of the magnet quadrants, is described. The sequence of processes is enumerated for the fabrication and assembly. After preliminary shakedown, periodic tests have shown no leaks to date. (auth)

4918

Brookhaven National Lab.

[COSMOTRON] MAGNET. PART 6. POWER SUPPLY. G. K. Green and E. E. Shelton. [1953] 17p. (BNL-1451)

The power for the magnet is supplied by a 1750-hp, 13,800-volt induction motor that drives a 21,000-kva, 12-phase, a-c generator and a 43-ton flywheel, rotating at approximately 900 rpm. The generator output is rectified through 24 double-grid ignitrons which also act as inverters returning most of the magnetic energy of the coil to the rotating set. (auth)

4919

Brookhaven National Lab.

[COSMOTRON] POLE-FACE WINDINGS. PART 1. DESIGN. J. P. Blewett, M. H. Blewett, W. H. Moore, and L. W. Smith. [1953] 18p. (BNL-1452)

At fields over 10,000 gauss the effects of saturation in the magnet cause deterioration of the field pattern which rapidly becomes serious enough to cause complete loss of the proton beam. This pattern can be restored adequately up to 14,000 gauss by passing current through single-layer windings on the faces of the magnet poles. Peak correction current required at 14,000 gauss is about 300 amp per radial inch of each winding. The pole-face winding returns are so arranged that the winding is almost completely decoupled from the main magnetizing winding. The windings and their power supplies are in place but are not yet energized. Several turns of the winding are used in a self-powered correction for the distortion of the magnetic median surface at injection fields. (auth)

4920

Brookhaven National Lab.

[COSMOTRON] POLE-FACE WINDINGS. PART 2. FABRICATION. John J. Mede. [1953] 8p. (BNL-1453)

The pole-face windings, for correction of saturation effects in the magnet, were wrapped in Fiberglas tape and then cast in a polyester-resin laminate. The process of fabrication and the materials used for casting are described. (auth)

4921

Brookhaven National Lab.

[COSMOTRON] R-F SYSTEM. PART 1. DESIGN PRINCIPLES. John P. Blewett. [1953] 16p. (BNL-1454)

The r-f system must supply a 2000-v r-f accelerating signal across an insulated gap in the vacuum chamber. During the 1-sec accelerating cycle the frequency must vary from about 370 kc to 4.2 Mc at a rate determined by the rate of change of the field in the gap of the cosmotron magnet. Frequency is swept in an oscillator whose resonant circuit includes a ferrite-loaded saturable inductor. The impedance of the gap and its associated shield is maintained by ferrite loading. A description is included of the sequence of control and switching operations in the r-f system during a complete cosmotron cycle. (auth)

4922

Brookhaven National Lab.

[COSMOTRON] R-F SYSTEM. PART 2. FREQUENCY CONTROL. J. P. Blewett, E. J. Rogers, and C. E. Swartz. [1953] 29p. (BNL-1455)

Frequency control in the cosmotron is based on a signal derived from a pick-up loop in the magnet gap. This signal is integrated electronically and is then distorted in a non-linear network to yield a control voltage for the saturable-core oscillator. System constants are chosen such that the

oscillator frequency has, at all times, the value associated with the instantaneous cosmotron magnetic field. Dynamic frequency is measured by counting cycles for one millisecond at any desired time during the cycle. Tests on the present system indicate that it is adequate, but that several simplifications are possible. (auth)

4923

Brookhaven National Lab.

[COSMOTRON] R-F SYSTEM. PART 3. POWER AMPLIFIER. M. Plotkin and L. C. L. Yuan. [1953] 22p. (BNL-1456)

The 2-volt signal from the low-level swept oscillator in the cosmotron frequency-control system is amplified to 2000 v, for application at the accelerating gap, by two units. The first, the intermediate-level system, includes the function of gating and a.v.c. The second, the high-level unit, is a push-pull, broad-band amplifier capable of an output of 150 kw. The gap voltage is maintained constant by an a.v.c. system operated from a detector directly across the accelerating gap. Metering, protection, and control techniques are described. (auth)

4924

Brookhaven National Lab.

[COSMOTRON] R-F SYSTEM. PART 4. ACCELERATING UNIT. J. P. Blewett, M. Plotkin, and E. J. Rogers. [1953] 22p. (BNL-1457)

The accelerating gap and its associated shield are driven by a broad-band amplifier. The impedance level at the gap is raised to the point at which it can be driven by conventional power tubes by loading the surrounding shield with ferromagnetic material. Extensive tests on loading materials led to the choice of nickel-zinc ferrite. About 2800 pounds of ferrite are required. Techniques are described for fabrication and assembly of the ferrite structure, and for excitation of the gap by the power amplifier. (auth)

4925

Brookhaven National Lab.

[COSMOTRON] R-F SYSTEM. PART 5. PROPERTIES OF FERROMAGNETIC FERRITES. J. P. Blewett, M. H. Blewett, and M. Plotkin. [1953] 26p. (BNL-1458)

Ferromagnetic ferrites are used in numerous applications in the cosmotron. For example, in the accelerating unit over a ton of ferrite is included. During the design of the cosmotron, much information was required about the various electrical and magnetic properties of ferrites. Since this information was not available, a detailed program of investigation of ferrite properties has been carried out. Results are presented of dielectric properties and of magnetic properties as functions of frequency, d-c and a-c field strengths, and temperature. A general discussion is included of the behavior of electromagnetic waves in ferrite structures. (auth)

4926

Brookhaven National Lab.

[COSMOTRON] INJECTION SYSTEM. PART 1. VAN DE GRAAFF ACCELERATOR. E. J. Rogers and C. M. Turner. [1953] 35p. (BNL-1459)

Protons, for injection into the cosmotron, are accelerated to about 3.6 Mev in a horizontal, pressurized Van de Graaff accelerator built by the High Voltage Engineering Corporation of Cambridge, Mass. The machine is rated at 4 Mev, peak. A pulsed ion source is included in the high-voltage terminal and is pulsed by an external circuit linked to the ion source through a light beam and photocell. Pulsed ion output includes about 1 ma of protons. The terminal voltage is stabilized to 1 part in 2000 by a servo loop that includes a deflection magnet, split-plate collector, and grid-controlled corona discharge. (auth)

4927

Brookhaven National Lab.

[COSMOTRON] INJECTION SYSTEM. PART 2. INJECTION OPTICS. J. G. Cottingham, W. H. Moore, E. J. Rogers, and C. M. Turner. [1953] 18p. (BNL-1460)

The injection optical system, through which the 3.6-Mev proton beam from the Van de Graaff accelerator enters the Cosmotron, consists primarily of a deflecting magnet and an electrostatic inflector in which the beam is deflected through angles of 25° and 30°, respectively. Viewing and detecting mechanisms are available for studies of alignment and ion optics. The ion-optical properties of the system have been studied in detail; parameters have been chosen which yield an injected beam, parallel in the horizontal plane and diverging within an angle of 0.003 radians in the vertical plane. (auth)

4928

Brookhaven National Lab.

[COSMOTRON] VACUUM SYSTEM. PART 1. VACUUM CHAMBER. D. D. Jacobus and I. J. Polk. [1953] 48p. (BNL-1461)

Details are given of the design, fabrication, and assembly of the vacuum chamber. Four quadrant-length units, each shaped to fit the magnet's curvature, are joined by expansion joints to stainless-steel straight-section boxes that house special component equipment. In the quadrant sections, the inner and outer walls are 1 in. thick, solid low-permeability stainless steel; to minimize eddy currents, the top and bottom parts consist of separated, stainless-steel bars. An airtight cover of Myvaseal rubber is stretched over the top and bottom of the complete quadrant section. Tests on other models are discussed, and out-gassing measurements on several materials are included. Gaskets in the system are Myvaseal, and measurements on its properties and techniques for its use are described. (auth)

4929

Brookhaven National Lab.

[COSMOTRON] VACUUM SYSTEM. PART 2. PUMPING SYSTEM. D. Kassner and C. Lasky. [1953] 18p. (BNL-1462)

Twelve 20-in. oil diffusion pumps are spaced around the magnet ring to evacuate the vacuum chamber. These pumps, backed by 8-in. booster pumps and mechanical fore-vacuum pumps, are connected to manifolds in the wall of the vacuum chamber through 16-in. valves and large rectangular transition boxes. A complete system of interlocks gives fully automatic control. Present minimum operating pressure in the cosmotron's vacuum chamber is 5×10^{-6} mm Hg. (auth)

4930

Brookhaven National Lab.

REVISION OF GAS SCATTERING THEORY. Ernest D. Courant. [1953] 8p. (BNL-1463)

Previous estimates of the loss of protons through gas scattering are revised to include effects of scattering through angles large enough for immediate particle loss. In multiple-scattering theory, overestimates of loss may occur through use of the Born approximation. Appropriate corrections are discussed. (auth)

4931

Brookhaven National Lab.

[COSMOTRON] CONTROL SYSTEM. PART 1. CENTRAL CONTROL AND WIRING. G. K. Green and R. R. Kassner. [1953] 31p. (BNL-1464)

Control circuits for the cosmotron radiate from a central control room and master terminal box. Remote control, indication, and protective monitoring of all components are provided on a central control console. Extensive interlocks are necessary to protect equipment. Programing circuits

automatically control the sequence of events during the operating cycle. (auth)

4932

Brookhaven National Lab.

[COSMOTRON] CONTROL SYSTEM. PART 2. TIMING SYSTEM. E. W. Dexter. [1953] 10p. (BNL-1465)

A gated timing system starts at the initial transient of the cosmotron magnet cycle. Time markers in intervals from 100 μ sec to 1 sec are available on patch-panel outputs. In addition, outputs are available at single specific times during the accelerating cycle. (auth)

4933

Brookhaven National Lab.

[COSMOTRON] CONTROL SYSTEM. PART 3. PEAKING STRIPS. S. Giordano, G. K. Green, and E. J. Rogers. [1953] 12p. (BNL-1466)

Precise markers, indicating predetermined magnetic field strengths, are produced by fine, high-permeability wires in the stray field of the cosmotron magnet. Control is obtained by regulation of the currents through a bias solenoid that surrounds the wire peaking strip. (auth)

4934

Brookhaven National Lab.

[COSMOTRON] CONTROL SYSTEM. PART 4. PICK-UP ELECTRODES. C. E. Swartz. [1953] 12p. (BNL-1467)

The circulating proton beam is bunched azimuthally by the r-f acceleration. The protons pass through insulated electrodes inside the vacuum chamber, and the voltage induced on these plates is used to monitor the beam and to explore its characteristics. The pick-up electrodes' signal is well above noise level. It can be displayed on an oscilloscope and utilized in many operations and investigations on the beam. (auth)

4935

Brookhaven National Lab.

THE COSMOTRON BUILDING. L. D. Stoughton. [1953] 8p. (BNL-1468)

Three wings house the cosmotron and its associated equipment, offices for personnel, and design laboratories and shops. The facilities in this building, including the cooling-water systems are described. (auth)

4936

Brookhaven National Lab.

EDDY CURRENT PHENOMENA IN THE COSMOTRON. M. Hildred Blewett. [1953] 25p. (BNL-1469)

In the cosmotron magnet, eddy currents in the half-inch laminations cause no serious effects except for a small increase in n-value at injection time. This increase needs no correction since it is compensated for by the reversed slope of the remanent field. Analyses of eddy-current effects in other metallic components are included, for example, in the pole-face windings and in the stainless-steel vacuum chamber. Serious shifts in the magnetic median surface result from eddy currents that arise when either inner or outer vertical wall of the vacuum chamber is misaligned. (auth)

4937

Brookhaven National Lab.

STUDIES OF INJECTION PHENOMENA IN THE COSMOTRON. M. Hildred Blewett, G. K. Green, R. R. Kassner, W. H. Moore, L. W. Smith, and H. S. Snyder. [1953] 39p. (BNL-1470)

An intensive study of the behavior of the proton beam has been made for the period just after injection, before the application of any accelerating field. The actual orbits have been traced for small variations in energy and time of injection in order to obtain optimum injection conditions. These orbits have been used to make further refinements on the adjustments of some of the injection components. The time required for the unaccelerated beam to spiral to

the inside wall of the vacuum chamber is used as a basis for the normal injection routine. (auth)

4938

Brookhaven National Lab.

CALCULATION OF THE [COSMOTRON] PROTONS' RADIAL OSCILLATIONS AT INJECTION. Ernest D. Courant and R. M. Sternheimer. [1953] 7p. (BNL-1471)

The radial oscillation of the first two revolutions after injection have been calculated for variations in injection timing, injection position, and initial angular direction. Graphs of some typical cases are included. (auth)

4939

Radiation Lab., Univ. of Calif., Berkeley

VERIFICATION OF SYNCHROTRON BEAM FINE STRUCTURE. Nelson Jarmie. Apr. 3, 1953. 7p. (UCRL-2165)

Qualitative verification of fine structure in the 322-Mev electron synchrotron is presented. The full-intensity photon beam was collimated and passed through a Pb sheet and a stilbene crystal viewed by a photomultiplier tube. Output from this arrangement was placed on the vertical plates of an oscilloscope, with sweep triggered by a timing pulse of the synchrotron. (K.S.)

4940

Radiation Lab., Univ. of Calif., Berkeley

QUADRUPOLE FOCUSING LENSES FOR CHARGED PARTICLES. Bruce Cork and Emergy Zajec. Apr. 15, 1953. 22p. (UCRL-2182)

A set of four strong-focusing magnetic-quadrupole lenses has been constructed and operated. Each lens consists of four air-cooled electromagnets with pole tips having a hyperbolic cross section. Each lens is 4 in. long and has an aperture 2 in. in diameter. Measurements of the magnetic field demonstrate that the hyperbolic cross section satisfies the requirements of a constant magnetic field gradient very well. The technique of deflecting a current-carrying flexible wire has been used to measure the trajectory of charged particles through the system of lenses. It has been observed that the strong-focusing requirements are satisfied. The system of lenses was then used to focus 0.5-Mev protons, 20-Mev deuterons, and 40-Mev α particles. The parallel beam of 0.5-Mev protons was detected by observing the incandescence of a quartz plate while the protons were bombarding it. The focused beam was less than 1 mm in diameter. The astigmatic 20-Mev deuteron beam from the 60-in. cyclotron was increased in current density by a factor greater than 30. (auth)

4941

FOCUSING OF HIGH ENERGY PARTICLES BY THE GRATING LENS. I. THE CONVERGENCE OF THE GRATING LENS. Michel-Yves Bernard. *J. phys. radium* **14**, 381-94(1953) June. (In French)

The properties of an electrostatic lens designed to focus particles of high energy are studied by using a source having a potential much lower than the acceleration potential. This setup, in which one of the electrodes is made from a metallic membrane permeable by the particles, is useful in linear ion accelerators to overcome the defocusing effect of the high-frequency fields. (tr-auth)

4942

INFLUENCES OF THE AMPLITUDE VARIATION OF AN ACCELERATOR FIELD UPON MOVEMENT OF IONS IN A LINEAR ACCELERATOR. Michel-Yves Bernard. *Compt. rend.* **236**, 2226-8(1953) June 8. (In French) (cf. NSA 7-3919.)

The author describes a certain number of interesting phenomena which are produced in linear ion accelerators when the accelerator field has an amplitude which increases with z . This behavior is favorable to the phase grouping

and gives weaker defocusing forces than fields in which the amplitude decreases or remains constant. (tr-auth)

RADIATION ABSORPTION AND SCATTERING

4943

Los Alamos Scientific Lab.

SMALL ANGLE CROSS SECTIONS FOR THE SCATTERING OF PROTONS BY TRITONS (thesis). Malcolm Eugene Ennis. June 1953. 111p. (AECU-2599; LADC-1453)

Experiments are described in which the differential cross section for the elastic scattering of protons by tritons in the lab. system from 15 to 150° at energies from 0.990 to 2.548 Mev were determined. Protons from a 2.5-Mev Van de Graaff accelerator were passed into a scattering chamber containing H³ gas and counts were made of the number of protons scattered from a small volume of gas in the beam into a counter subtending a known solid angle. By rotating the counter around the small scattering volume, the differential cross section was determined as a function of angle. Extensive descriptions are presented of the gas scattering chamber, accelerator, and electronic circuitry. Data are presented showing weighted averages of all runs taken. (L.M.T.)

4944

Livermore Research Lab., Calif. Research and Development Co.

TOTAL ATTENUATION CROSS SECTIONS FOR HIGH ENERGY PROTONS. D. A. Hicks and A. J. Kirschbaum. Dec. 17, 1952. 23p. (MTA-28)

Measurements of the total attenuation cross sections of protons in Be, C, Al, Cu, Pb, and U have been made over three different energy ranges: 160 to 205, 205 to 270, and 270 to 335 Mev. The results seem to be in agreement with the Fernbach extension of the transparent-nucleus theory. The ratios of the diffraction cross sections to the absorption cross sections are smaller than would be expected from the original Serber theory. The absorption cross section varies as $A^{0.75}$. (auth)

4945

Stanford Univ.

INTERPRETATION OF ELECTRON SCATTERING EXPERIMENTS. L. I. Schiff. June 24, 1953. 21p. (NP-4648; Technical Report 1)

Experiments on the elastic scattering of fast electrons by several elements are interpreted with the help of the first Born approximation. These experiments imply nuclear charge distributions that are peaked at the center and taper off smoothly. The root-mean-square radii of the charge distributions and the nuclear coulomb energies are, however, in approximate agreement with those computed from the usual uniform charge distribution. The effects of radiation loss and nuclear excitation are discussed qualitatively, and the effect of a nuclear electric quadrupole moment is considered quantitatively. It is concluded that none of these can account for the discrepancy between the observed scattering cross section which decreases monotonically with increasing angle, and the diffraction minima and maxima expected from a uniform charge distribution with a sharp or moderately rounded edge. It seems likely that higher-order corrections to the first Born approximation will not make a qualitative difference in the computed cross section; theoretical improvements are now being undertaken. (auth)

4946

RESONANT SCATTERING OF SLOW NEUTRONS. B. N. Brockhouse. *Can. J. Phys.* **31**, 432-52(1953) April. (cf. NSA 5-6467, 6468)

A method is described for measurement, as a function of neutron energy, of the scattering cross section for slow

neutrons of materials having high absorption. The necessary corrections are discussed. The results are normalized to a V scattering cross section of 5.07 barns inferred from the measured total cross section, $\sigma_T = 5.07 + 5.29(0.025/E(\text{ev}))^{1/4}$. Measurements are presented for the low energy neutron resonances in Cd, Sm, Gd, Dy, Eu, Rh, and In. The single-level Breit-Wigner formula is accurately obeyed for Cd and Sm but not for Gd in which two resonances contribute. The scattering results indicate that the absorption cross sections of Cd and Sm at resonance are higher than the values previously accepted. This has been confirmed by total-cross-section measurements on Cd for which the Breit-Wigner parameters are $E_0 = 0.180 \pm 0.003$ ev, $\Gamma = 0.113$ ev, $\sigma_{a0} = 7750$ barns, $\sigma_p = 4.7$ barns, $a_R = 7 \times 10^{-13}$ cm. The spin of the compound nucleus is unity. For Sm^{149} the spin of the compound nucleus (0.096 ev resonance) is $i + \frac{1}{2}$. The scattering cross section of Eu for neutrons of energy 0.03 to 0.15 ev is 8 barns, almost independent of the energy. The scattering cross section of Dy is 100 barns at 0.03 ev and decreases slowly with increasing energy, thus confirming the existence of a level at negative neutron energy. The spin of the compound nucleus for the 1.26-ev resonance in Rh^{103} is found to be unity and that for the 1.45-ev resonance in In^{115} is found to be four. (auth)

4947

SCATTERING AND ABSORPTION OF GAMMA RAYS. Paul Maignan. *Ann. phys.* **8**, 202-58(1953) Mar.-Apr. (In French)

The theory of γ -ray absorption and scattering is applied to the case of a source in an infinite homogeneous medium. Experiments were conducted using Th^{228} in a water medium. Good theoretical agreement was found within small distances from the source. (K.S.)

4948

THEORY OF THE PENETRATION OF γ -RAYS THROUGH THIN BARRIERS. John P. Vinti. *Phys. Rev.* **91**, 345-8 (1953) July 15.

A theoretical investigation is made of the penetration of monochromatic, parallel, unpolarized, normally incident γ rays through barriers so thin that photons scattered more than twice can be neglected. The principal contribution of the paper is the derivation of a simple solution for the distribution function n_2 of the twice-scattered photons, capable of significant physical description and reasonably easy use for accurate computations. Comparison with experiment is made by computing the expected counting rate in an experiment by Faust on the penetration of 1.25-Mev γ rays from Co^{60} through flat sheets of Al. Calculated values appear to be within the experimental error for thicknesses of one inch or less. A significant increase in the discrepancy at a thickness of two inches indicates that photons scattered more than twice begin then to be important. (auth)

4949

THE ENERGY LOSS OF A FAST CHARGED PARTICLE BY ČERENKOV RADIATION. R. M. Sternheimer. *Phys. Rev.* **91**, 256-65(1953) July 15. (cf. NSA 7-1736).

The calculation of the Cherenkov loss in emulsion is discussed. The loss in traversing the AgBr grains is 2.2×10^{-3} Mev/g cm^{-2} which is small compared to the relativistic rise of the total ionization loss (0.12 Mev/g cm^{-2}). For gases the Cherenkov loss is somewhat larger, being 0.14 Mev/g cm^{-2} for He and 0.04 Mev/g cm^{-2} for O_2 . The theory is in reasonable agreement with experiments on the grain count in emulsion and on the droplet count in a cloud chamber filled with O_2 . An approximate analytic expression for the Cherenkov loss is obtained for gases. Values of the density effect for 6 additional substances are presented. (auth)

4950

THE ENERGY LOSS OF HYDROGEN, HELIUM, NITROGEN, AND NEON IONS IN GASES. Peter K. Weyl. *Phys. Rev.*

91, 289-96(1953) July 15.

The rate of loss of energy of protons, deuterons, He, N, and Ne ions in the energy range of 150 to 450 kev has been measured in the gases H, He, air, and A. The ions were sent through a differentially pumped gas system and the energy loss in the forward direction due to the gas was determined with an electrostatic analyzer. The results for protons agree with recent measurements at the California Institute of Technology. At the same energy, the stopping cross sections are roughly the same for Ne and He ions. The stopping power for N ions is greater than that for Ne ions of the same energy by a factor ranging from 1.3 to 1.9, illustrating the importance of external electron configurations in determining stopping powers in our energy region. With the exception of H gas, the cross sections for the heavier ions follow a power law. The dependence ranges from $E^{0.33}$ to $E^{0.59}$, depending on the gas and ion, with several of the curves following an $E^{1/2}$ power law. (auth)

4951

THE CALCULATION OF THE SCATTERING OF BODIES WITH SPIN $\hbar/4\pi$ BY A COULOMB PSEUDOSCALAR POTENTIAL. Gérard Petiau. *Compt. rend.* 236, 2303-5(1953) June 15. (In French)

The calculation of the scattered wave corresponding to a monochromatic incident plane wave for a body of spin $\hbar/4\pi$ is represented by the solutions of the Dirac waves in the case of a pseudoscalar interaction in $1/r$. (tr-auth)

RADIATION EFFECTS

4952

CALORIMETRIC MEASUREMENTS OF X RAY ENERGY; IONIZATION OF AIR AND RARE GASES; NEW DETERMINATIONS OF THE CONSTANTS: ION PAIR ENERGY FORMATION, ϵ , FLUORESCENT YIELD, u_s , AMPLITUDE OF ABSORPTION DISCONTINUITIES, δ . M. H. Tellez-Plasencia. *Ann. phys.* 8, 169-201(1953) Mar.-Apr. (In French)

Previous theory on x-ray ionization of gases is extended by taking secondary effects into account. Calorimetric experiments were performed with Ne, A, Kr, and Xe, and new values are obtained for several constants involved in ion-pair production. (K.S.)

4953

THE "DIFFERENTIAL IONIZATION" BY α RADIATION IN CdS CRYSTALS. Chr. Gerthsen and W. Kolb. *Z. Naturforsch.* a8, 315-17(1953) May. (In German)

The number of electrons emitted by CdS single crystals during α radiation is dependent on the velocity of the α particles. This is analogous to the differential ionization of gases which causes ion pairs during α radiation. (tr-auth)

4954

EFFECT OF TEMPERATURE ON THE CONDUCTIVITY INDUCED IN INSULATORS BY X-RAYS. J. F. Fowler and F. T. Farmer. *Nature* 171, 1020-1(1953) June 6.

The temperature coefficient of both irradiated and non-irradiated insulation material was determined to establish the energy levels of conduction bands under the two conditions. Results are presented graphically. Under irradiation at room temperature, the conductivity was found to increase by 5.6%/°C. For nonirradiated material the increase was found to be 19%/°C. (C.H.)

RADIOACTIVITY

4955

Mound Lab.

DETERMINATION OF HALF LIFE OF POLONIUM-210 BY COUNTING: FINAL REPORT. Mary Lou Curtis. June 1, 1951. Decl. July 9, 1953. 8p. (AECD-3536; MLM-575)

The half life of Po^{210} is determined as $138,374 \pm 0.032$

days by the use of the Logac, a low-geometry alpha counter, over a period of 328 days. The method for the preparation of the pure sample and calculation of its half life are presented. (J.A.G.)

4956

Brookhaven National Lab.

RADIATIONS FROM Rb^{86} AND Rb^{86m} . Robert B. Schwartz, M. L. Perlman, and W. Bernstein. [1952] 9p. (BNL-1431)

An upper limit of 1×10^{-3} is determined for the ratio of K capture to negative β emission in the decay of 19.5-day Rb^{86} . The 1-min Rb^{86} isomer is shown to decay by isomeric transition, probably E4 or perhaps E3, with the emission of 560-kev γ rays. (auth)

4957

Brookhaven National Lab.

AVERAGE CHARGE ON THE DAUGHTER ATOMS PRODUCED IN THE DECAY OF A^{37} AND Xe^{131m} . M. L. Perlman and J. A. Miskel. [1953] 20p. (BNL-1440)

The average charges on the Cl^{37} and Xe^{131} atoms produced in the transitions $A^{37} \rightarrow Cl^{37}$ and $Xe^{131m} \rightarrow Xe^{131}$ are found to be $+3.41 \pm 0.14$ and $+8.5 \pm 0.3$ electron charges, respectively. Estimates of the values to be expected from fluorescent and Auger processes and from Z change are made. (auth)

4958

A DETERMINATION OF THE HALF LIVES OF SOME MAGNETIC DIPOLE γ -RAY TRANSITIONS. R. L. Graham and R. E. Bell. *Can. J. Phys.* 31, 377-92(1953) April.

A number of magnetic dipole γ -ray transitions have been studied using a coincidence circuit of short resolving time ($2\tau_0 = 2 \times 10^{-9}$ sec), a two-lens single β -ray spectrometer, a pair of lens spectrometers placed end to end with coincidence counting of the focused radiations from a single source, and a scintillation spectrometer. Lifetimes have been measured using the delayed coincidence method and, where feasible, conversion coefficients and K/L ratios obtained. Comparison is made with theoretical estimates of the lifetime-energy relation for M1 γ -ray transitions. The new results are as follows:

Nucleus	γ -Ray energy, kev	Half life, sec	α K	K/L
Te^{123}	159	$1.9 \pm 0.3 \times 10^{-10}$		
Te^{125}	35.4	$1.58 \pm 0.15 \times 10^{-9}$		
Cs^{133}	81	$6.0 \pm 0.4 \times 10^{-9}$	1.77	7.5
Cs^{135}	248	$2.8 \pm 0.8 \times 10^{-10}$		7.0
Pm^{147}	91.5	$2.44 \pm 0.08 \times 10^{-9}$	1.8	7.3
Tl^{208}	40 (A line)	$< 7 \times 10^{-11}$		
Bi^{212}	238 (F line)	$< 2 \times 10^{-11}$		

4959

THE INTERNAL BREMSSTRAHLUNG SPECTRUM OF P^{32} IN THE LOWER ENERGY REGION. Gérard-André Renard. *J. phys. radium* 14, 361-5(1953) June. (In French) (In French)

The photon spectrum of the internal bremsstrahlung of the nuclide P^{32} has been studied in the energy region from 3 to 30 kev by the proportional counter method. The agreement with theory is satisfactory. (tr-auth)

4960

FISSION YIELDS OF THE STABLE AND LONG-LIVED ISOTOPES OF CESIUM, RUBIDIUM, AND STRONTIUM AND NUCLEAR SHELL STRUCTURE. D. R. Wiles, B. W. Smith, R. Horsley, and H. G. Thode. *Can. J. Phys.* 31, 419-31(1953) April.

The relative yields of the isotopes of Cs, Rb, and Sr from thermal-neutron fission of U^{235} have been determined mass spectrometrically. The Cs isotope yields are combined with those obtained previously for the Xe isotopes to give high precision yields for mass chains from 131 to 137. In this

work neutron-capture reactions have been considered and corrections made where these take place to an appreciable extent. The results give further evidence of abnormal yields in the 82-neutron shell region. The half life of Cs^{137} was determined and found to be 33 ± 2 years. (auth)

4961

STUDY OF THE FINE STRUCTURE OF THE α RADIATION OF IONIUM. Georges Valladas and René Bernas. *Compt. rend.* **236**, 2230-2(1953) June 8. (In French)

The α fine structure of the low intensity rays of Th^{230} has been studied with an impulse ionization chamber. The new rays, 210 and 245 kev of the α_0 fine structure, were found. (tr-auth)

4962

POLARIZATION OF THE THREE-PHOTON ANNIHILATION RADIATION. L. Leipuner, R. Siegel, and S. DeBenedetti. *Phys. Rev.* **91**, 198-9(1953) July 1.

A triple-coincidence-counter method was used to investigate the three-photon annihilation of positrons and electrons. A sample of Na^{22} was placed in a bell-shaped Al container filled with a dense atmosphere of SF_6 . Positrons from this source formed positronium and provided a sufficiently intense source of 3-quantum annihilation events. Two of the NaI scintillation counters placed 120° apart detected two of the three annihilation rays directly while the third counter detected the third ray after it had been scattered, in polystyrene, parallel or perpendicular to the plane of the scatterer and first two counters. The average ratio of parallel to perpendicular counts was 1.87 ± 0.23 . (L.M.T.)

4963

RADIOACTIVE CHARGING THROUGH A DIELECTRIC MEDIUM. E. G. Linder and P. Rappaport. *Phys. Rev.* **91**, 202(1953) July 1.

Results of a study of electrostatic charging in which charged particles pass from a β emitter through a dielectric to a collector are discussed. Sr^{90} - Y^{90} sources were used with a dielectric of polystyrene. Current-voltage characteristics made with charging currents of 10^{-11} and 2.5×10^{-10} amp indicated voltages of 3700 and 6600 v, respectively, could be reached. These gave values of 7×10^{15} and 0.5×10^{16} ohm-cm, respectively, for the specific resistance of polystyrene. Since literature values range from 10^{18} to 10^{22} , the lower value is attributed to bombardment-induced conductivity. The effects of factors such as a dielectric thickness, charge-soakage, and backscattering of electrons are discussed. It is thought that radioactive voltage or current sources may have considerable applications in the electronics field. (L.M.T.)

4964

RADIATIONS FROM RaD AND RaE. C. S. Wu, F. Boehm, and E. Nagel. *Phys. Rev.* **91**, 319-27(1953) July 15.

The electron and γ spectra from RaD and RaE (Pb^{210} and Bi^{210}) have been thoroughly investigated. The γ radiation from RaD was studied with both Kr and A proportional counters with brass and Al cathodes. The L_α , L_β , and L_γ radiations of Bi were observed and identified with a critical absorber. The intensity ratios of L_α : L_β : L_γ are 1:1:0.2. The previously reported 7.8-kev (10%) line was not found but could be strongly excited by Cu backing. The weak 23-kev line could be contributed from the piling effect of the detecting system. The conversion electrons of RaD were investigated in a solenoid magnetic spectrometer to obtain the L and (M + N) conversion coefficients. The results are:

$$N_{L_1}/N_\beta = 64\%, N_{M+N}/N_\beta = 21\%, N_{L_2+M+N}/N_\beta = 85 \pm 5\%.$$

The conversion electrons of RaD were again investigated with a 180° β spectrometer with a resolution of 0.8% and a

counter window of $\sim 6 \mu\text{g}/\text{cm}^2$. The L_I , L_{II} , and L_{III} conversion lines of the 46.5-kev γ ray were resolved. The ratio of L_I : L_{II} : L_{III} : M_I : M_{II} : M_{III} : N_I : N_{II} : N_{III} : N_{IV} : N_V : N_{VI} : N_{VII} : N_{VIII} + 0 are 1:0.075:0.007:0.25:0.006:0.07:0.007. From the ratios of the L-subshell conversion electrons, the 46.5-kev transition is interpreted as an M1 type. The upper limit of the intensity of the reported lines at 42, 37, and 31 kev must be less than 0.5% per disintegration if the same conversion coefficient is assumed. The unconverted 46.5-kev γ radiation is 0.07 ± 0.02 per disintegration. Thus the excited state of 46.5 kev in RaE can account for $92 \pm 5\%$ of the disintegrations. Neither internal-conversion electrons nor nuclear γ radiations are found in RaE. A faint x ray (~ 80 kev) of the order of 10^{-4} per disintegration due to the ionization effect was observed in RaE. A brief discussion of the decay scheme of RaD and the possible spin assignments of various levels is included. (auth)

4965

DISINTEGRATION OF Sb^{124} . L. M. Langer, N. H. Lazar, and R. J. D. Moffat. *Phys. Rev.* **91**, 338-41(1953) July 15.

The radioactive decay of Sb^{124} has been reinvestigated in the large magnetic spectrometer and with scintillation techniques. K and L photoelectron lines are observed for γ rays of energy 0.603, 0.641, 0.716, 1.68, and 2.09 Mev. The curve Fermi plot of the highest energy β group is straightened by a once-forbidden correction factor consistent with a general STP β interaction for spin-change of unity. Analysis in this manner gives β -ray energies and intensities of 2.317 Mev, 21%; 1.602, 7%; 0.966, 9%; 0.61, 49% and 0.24, 14%. The 0.603-Mev γ ray is identified as electric quadrupole. A consistent decay scheme, substantiated by γ - γ and β - γ coincidences is proposed. (auth)

4966

GAMMA-RADIATION FROM ARSENIC 77. S. A. Reynolds, G. W. Leddicotte, and H. A. Mahlman. *Phys. Rev.* **91**, 333(1953) July 15.

Two previously unreported γ rays (245 and 520 kev) have been observed in the decay of As^{77} . (auth)

4967

GAMMA-RAY SPECTRUM OF IONIUM (Th^{230}). F. Rasetti and E. C. Booth. *Phys. Rev.* **91**, 315-18(1953) July 15.

The γ spectrum following the α decay of Th^{230} was investigated using a scintillation spectrometer. The following γ energies (in kev) and intensities (quanta per disintegration) were observed: 68(0.010); 142(0.0014); 255(0.0005). The 68- and 142-kev lines were found to be emitted in cascade; the third apparently represents a transition to the ground state. A level diagram for the product nucleus, Ra^{226} , is suggested. (auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

4968

Los Alamos Scientific Lab.

THE CRYSTAL STRUCTURE OF NEODYMIUM METAL AND OF NEODYMIUM MONOXIDE. F. H. Ellinger. [1953] 11p. (AECU-2593; LADC-1460)

The crystal structure of Nd metal has been found to be double-hexagonal close-packed of cell dimensions $a_0 = 3.655 \pm 0.001$ A, $c_0 = 11.796 \pm 0.004$ A, $c/a = 3.227$. The calculated density is $D_x = 7.021$ g/cm³. The 4 atoms in the unit cell are in the positions: (0,0,0), (0,0, $\frac{1}{2}$), ($\frac{1}{3}$, $\frac{2}{3}$, $\frac{1}{4}$), ($\frac{2}{3}$, $\frac{1}{3}$, $\frac{3}{4}$) of space group $P6_3/mmc$. The average radius of the Nd atom is 1.820 A. The structure is known to be stable up to 680°C . The crystal structure of NdO has been found to be f.c.c. of the NaCl type with $a_0 = 5.068 \pm 0.002$ A. The calculated density is $D_x = 8.18$ g/cm³. (auth)

4969

Los Alamos Scientific Lab.

THE CRYSTAL STRUCTURE OF SAMARIUM METAL AND

OF SAMARIUM MONOXIDE. F. H. Ellinger and W. H. Zachariasen. [1953] 12p. (AECU-2595; LADC-1455)

Sm metal is found to be rhombohedral with unit-cell dimensions of $a = 8.982 \pm 0.004$ Å and $\alpha = 23.31 \pm 0.02^\circ$. The unit cell contains three atoms giving a calculated density of $\rho = 7.52$ g/cm³. The space group is $R\bar{3}m$ (D_{3d}^5) and the atomic positions are: 1 Sm in (000), 2 Sm in $\pm(u, u, u)$ with $u = 0.222 \pm 0.003$. Each Sm atom has six ligands at 3.587 Å and six at 3.629 Å, giving a mean metallic radius of 1.804 Å. The structure is close-packed, the period along the threefold axis being 9 times the separation of consecutive close-packed layers. The sequence of layers is [ABABCBCAC] A^{***}. The observed interatomic distances show that Sm has to be assigned three valence electrons. By heat treatment of Sm metal a coating of the monoxide is formed. SmO has the NaCl type of structure with $a_0 = 5.015 \pm 0.050$ Å, the reason for the variation in the unit-cell edge being uncertain. (auth)

4970

Ames Lab.

THE RESISTIVITY OF LANTHANUM, CERIUM, PRASEODYMIUM AND NEODYMIUM AT LOW TEMPERATURES. Nancy R. James, Sam Legvold, and Frank H. Spedding. Mar. 1952. 54p. (ISC-229)

The electrical resistivity of La, Ce, Pr, and Nd was measured between room temperature and approximately 2°K. The behavior was found to be affected by the method of preparation, the heat treatment, and the crystal structure of the samples, the latter bearing the greatest significance. The decrease with temperature of the resistivity of all samples was nearly linear at room temperature in general agreement with theory. At very low temperatures the ideal resistivity, $[\rho]$, of La and Pr was found to obey the empirical equation $[\rho] = aT^b$, where T is the absolute temperature and a and b are constants. The face-centered cubic modification of La was found to possess a much lower resistivity at ordinary temperatures than the hexagonal close-packed form. It was hypothesized that the hexagonal form is stable at room temperature and that the f.c.c. structure undergoes a spontaneous transformation to the hexagonal form. The transformation may be inhibited in extruded specimens. An average superconducting transition temperature was found to be 5.8°K. The transition in Ce from the normal f.c.c. to the condensed f.c.c. modification was found to begin at a temperature between 100 and 120°K and to be accompanied by a large decrease in resistivity. The f.c.c. crystals may transform into the hexagonal structure at a slow rate which depends upon the rate of cooling from the annealing temperature to room temperature. An anomalous decrease in the resistivity of Ce which occurred at a temperature between 11 and 14°K was attributed to a transition from the h.c.p. to the condensed f.c.c. structure, or possibly, to a condensed hexagonal structure. An anomalous decrease in the resistivity of Nd appeared at approximately 12°K. A comparison of the h.c.p. modification of La with Nd indicated that a decrease in resistivity was correlated with an increase in resistivity. (auth)

4971

MULTIPLICITY IN X-RAY EMISSION SPECTRA. I. B. Borovsky and T. M. Golovner. Translated from *Doklady Akad. Nauk S.S.S.R.* 88, 233-6(1953). 4p. (NSF-tr-7; D-88-233)

A brief abstract of this article appears in *Nuclear Science Abstracts* as NSA 7-3050. (J.S.R.)

SHIELDING

4972

ECONOMICAL SHIELDING FOR MULTICURIE SOURCES.

R. F. Obrycki, R. M. Ball, and W. C. Davidon. *Nucleonics* 11, No. 7, 52-3(1953) July.

An economical method for shielding and storing a 25-c Co⁶⁰ source is described. The source holder is submerged in mineral oil in a pipe sunk in the ground. When in use, the source is raised to the top of the pipe by magnetic coils. Schematic sketches are included of the unit and the source holder. (C.H.)

SPECTROSCOPY

4973

Radiation Lab., Univ. of Calif., Berkeley

STUDIES IN β - AND γ -RAY SPECTROSCOPY (thesis).

Harry Tyson Easterday. Mar. 1953. 41p. (UCRL-2162)

Energy determinations have been made using the conversion and photoelectron spectra and scintillation-crystal pulse-height analysis for twelve γ rays associated with the Rb⁸² decay (6.3 hr, β^+ , K capture). The β^+ spectrum is found to contain four allowed components of maximum energies 1080, 890, 610, and 300 keV. A tentative decay scheme is suggested. The decay of Cu⁶⁷ (61 hr, β^-) has been fitted into the known decay scheme of Zn⁶⁷. The β spectrum contains three components of upper energies 577, 484, and 395 keV and conversion electrons from 92- and 182-keV transitions. The multipole orders of transitions between levels in Zn⁶⁷ have been measured and level configurations postulated, on the basis of the shell model of the nucleus, which are consistent with the decay schemes of Cu⁶⁷ and Ga⁶⁷. Multipole-order measurements have been made for two transitions involved in the Se⁷³ decay (7.1 hr, β^+ , K capture). The 67-keV isomeric transition in Se⁷³ is shown to be E3 and the 360-keV transition between the first excited and ground states of As⁷³ is found to be M2. Neither of these transitions can be reconciled with the shell model if the decay scheme as it now stands is correct. Details are given as to the design of the photo-converter and as to methods used in multipole-order measurements. An apparatus used for NaI-Tl crystal pulse-height analysis is described. (auth)

4974

MEASUREMENT OF THE HIGHER LIMITS OF THE β^+ SPECTRA OF THE MIRROR NUCLEI P²⁹ AND Cl³³. Maurice Nahmias and Tosiko Yuasa. *Compt. rend.* 236, 2399-2401 (1953) June 22. (In French)

By use of the method of counting scintillations and proportional amplification, the limits of the β^+ spectra of P²⁹ and Cl³³ have been found. The values 3.9 ± 0.2 MeV and 4.2 ± 0.2 MeV, respectively, are in good agreement with the theory of nuclear forces independent of the charges and in disagreement with the research of Peck on the reaction Si²⁸(d,n)P²⁹ + Q. (tr-auth)

4975

HYPERFINE STRUCTURES OF THE RESONANCE LINES OF INDIUM (In¹¹⁵). G. V. Deverall, K. W. Meissner, and G. J. Zissis. *Phys. Rev.* 91, 297-9(1953) July 15.

In the process of developing an atomic-beam light source for use at high oven temperatures an investigation of the In¹¹⁵ resonance lines at 4511 and 4101 Å was carried out. The employment of a well-collimated atomic beam, excited by electron impact, and of a Fabry-Perot interferometer made it possible to resolve clearly all components of the hfs of both lines. The complete resolution of the line 4511 Å has not been accomplished with other light sources by other investigators. The high spectroscopic accuracy led to values of the hyperfine splittings of the $5^2P_{1/2,3/2}$ terms which agree within ± 0.0004 cm⁻¹ with the values obtained by microwave methods. Furthermore, a precise value for the hyperfine splitting of the $6^2S_{1/2}$ term was obtained, namely 0.2814 ± 0.0005 cm⁻¹. (auth)

THEORETICAL PHYSICS

4976

THE FORMAL THEORY OF SCATTERING. M. Gell-Mann

and M. L. Goldberger. Phys. Rev. **91**, 398-408(1953) July 15.

The theory of scattering is developed from first principles with strict attention to the question of the preparation of the state vector of the system appropriate to a description of scattering. The connection between the present formulation and the more conventional interaction representation and S-matrix presentations is traced. The wave matrix of Møller is introduced and the existence of bound states is discussed in connection with it. A number of applications to rather involved processes are discussed. Finally, the problem of self energies in field-theoretic scattering calculations is treated. (auth)

4977

TWO-PARTICLE POTENTIAL FROM THE BETHE-SALPETER EQUATION. Wilhelm Macke. Phys. Rev. **91**, 195(1953) July 1.

In previous treatments concerning the two-particle potential between two fermions due to interaction with a boson field, the interaction terms of higher order are represented by nonrelativistic graphs, distinguishing in addition the sequence of transitions and intermediate states. The author questions why the strongly diverging vacuum graphs do not appear, since their influence on the energy denominators is such that they are not separable. Also, it is held impossible to recognize the divergent parts of the graphs as terms of mass and charge renormalization. Results are presented of an effort to clear up this situation in which a rigorous treatment of the two-particle potential was carried through, starting with the relativistic Bethe-Salpeter equation and passing on from this to the one-time formalism. (L.M.T.)

4978

ANGULAR CORRELATION IN ALLOWED β -TRANSITIONS. M. E. Rose. Phys. Rev. **91**, 197(1953) July 1.

The problem of deducing information concerning the β interaction from β -recoil angular-correlation experiments, is discussed. (auth)

4979

THREE-BODY SCATTERING PROBLEMS. A. Dalgarno. Phys. Rev. **91**, 198(1953) July 1.

Borowitz and Friedman (Phys. Rev. **89**, 441(1953)) stated that, in the case of ionization by atoms by electron impact, the result of Mott and Massey (Theory of Atomic Collisions, 2nd ed., Chap. VIII, Oxford, Clarendon Press, 1949) diverges. This note points out that their result, correctly interpreted, does not diverge and is, in fact, on the same basis as that of Borowitz and Friedman, the difference between the two being the familiar post-prior discrepancy. (L.M.T.)

4980

SPIN-ORBIT COUPLING IN PSEUDOSCALAR MESON THEORY. Lawrence Dresner. Phys. Rev. **91**, 201-02(1953) July 1.

Lévy (Phys. Rev. **88**, 72, 225(1952)) and Klein (Phys. Rev. (to be published)) have pointed out that the properties of the pseudoscalar matrix γ_5 make it possible to obtain adiabatic nuclear potentials which contain spin-orbit terms. Both Lévy and Klein have calculated the lowest-order spin-orbit corrections to the two-nucleon "two-pair" potential. This note reports the results of extending these calculations to include some other important potentials. (L.M.T.)

4981

ON THE SCATTERING PROBLEM IN PSEUDOSCALAR MESON IN PSEUDOVECTOR COUPLING. Katurō Sawada. Progr. Theoret. Phys. (Japan) **9**, 455-67(1953) Apr.

The theoretical investigation of meson-nucleon scattering given by Brueckner (Phys. Rev. **86**, 106(1952)) which fits very well with the experimental data is based on the phenom-

enological considerations with the mixed use of weak- and strong-coupling theories. The weak-coupling treatment was abandoned owing to its failure to explain the well-known scattering data even qualitatively. These weak-coupling calculations are Born approximation. The well-known threshold rise of the cross section is given by pseudoscalar mesons with pseudovector coupling, but there is no assurance that the Born approximation is allowed. In the weak-coupling case, the effective-scattering hamiltonian can be easily obtained by a canonical transformation (for example, assuming the coupling to be weak, retain only the second-order term), but if this is regarded as a "potential" which causes the scattering of the meson, the singularity of this "potential" is so strong that the Born approximation does nothing, and just as in the theory of nuclear forces the problem can be solved with this "potential". (The word "potential" does not mean that the meson scattering can be represented by potential scattering; the quantity which appears in place of potential is called "potential".) A calculation is performed firstly deriving the "potential" under the weak-coupling assumption and the dynamical problem of the system is then solved correctly (not in Born approximation) for the problem of meson-nucleon scattering. This is just the way taken up to date in the meson theory of nuclear force, i.e., deriving the nuclear potential under the weak-coupling assumption and solving the Schrodinger equation with this potential exactly. The "potential" derived from pseudoscalar mesons with pseudovector coupling is very singular and changes its sign and magnitude for different total isotopic spin and angular momentum of the system. It is seen that the virtual level resonance takes place for the $I = \frac{3}{2}$ and $J = \frac{3}{2}$ state. The conclusion is roughly the same as that of Brueckner. The divergences appear many places but can be summed up to the effective coupling constant aside from the position of virtual level. (auth)

4982

DIFFICULTY OF DIVERGENCE OF THE PERTURBATION METHOD IN THE QUANTUM FIELD THEORY. Ryōdō Utiyama and Tsutomu Imamura. Progr. Theoret. Phys. (Japan) **9**, 431-54(1953) Apr.

The behavior of the S matrices is investigated in the cases of two systems with specified lagrangians. The series representation of S in powers of the coupling constant diverges although each term of this series is finite by virtue of the non-local form factor. The divergence of this series results from the fact that the number of graphs corresponding to the nth term increases rapidly with the increase in n. The number of graphs is estimated by taking advantage of the Green function. (auth)

4983

ON THE ELECTRON-NEUTRINO ANGULAR CORRELATION. Masato Morita. Progr. Theoret. Phys. (Japan) **9**, 345-58(1953) Apr.

The electron-neutrino angular correlation functions are calculated for the allowed and first-forbidden transitions in the Fermi theory of β decay, taking into account the effect of the nuclear charge. The interferences which arise due to squaring of terms in the interaction are worked out perfectly. The Majorana theory is also handled for the allowed transition. The differences observed between the theories are not serious. The experimental data of P^{32} are consistent with the tensor interaction. (auth)

4984

ON THE PION-NUCLEON SCATTERING. Yoshihiko Miyachi. Progr. Theoret. Phys. **9**, 469-70(1953) Apr.

Field theories with non-localized interactions have been investigated by many authors. Their main purpose has been the construction of a convergent field theory, while applica-

tions to practical problems have been of secondary importance. On the other hand, recent experimental findings on pion-nucleon scattering differ widely from the perturbation theoretical predictions and many works have been done on this subject. In this note the non-localized interaction is considered as a possible mechanism of providing a consistent description of a pion-nucleon interaction, and the extent to which an approach can be made to the satisfactory interpretation of the pion-nucleon scattering phenomena is investigated. (auth)

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